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and
AIRCRAFT ENGINEER

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The Outlook

Atlantic Aircraft

ALTHOUGH the question asked by Lord Balfour of Inchrye in the House of Lords about the reported proposal to purchase a further batch of Constellations from Lockheeds did not draw from the Minister of Civil Aviation anything more definite by way of official reply than confirmation that the matter is being considered, it is well known in aviation circles that representatives of Lockheeds and of the Bristol Aeroplane Company have been examining the possibility of fitting Centaurus engines in the Constellation.

One can see Lockheed's point of view: the cancellation of the order by American operating companies left them with a number of Constellations on hand. From the British angle the fitting of Centaurus engines would further improve what is already a very good aircraft type and make it better than anything else flying the Atlantic, thus enabling B.O.A.C. to compete on better than equal terms with other operators.

The crux of the whole matter is, of course, dollars. At the rate at which the American loan is being used up —on tobacco and films rather than on re-equipping our industries—the Government obviously has to think very hard before sanctioning further dollar purchases of any sort. The use of Centaurus-engined Constellations on the Atlantic route should prove fairly economical, but the operational saving could not go very far towards reducing B.O.A.C.'s losses. Unless, therefore, the Constellations can be bought for a very reasonable price, it would appear to be impracticable to adopt this scheme which, but for the dollar difficulty, is very attractive.

It is rather remarkable that, in the panic about suitable aircraft, no one in authority has raised his voice, in public at any rate, to remind those concerned that in addition to the second Shetland flying-boat, which is now well advanced, there are at the Short works at Rochester sufficient "bits and pieces" for another half-dozen or so.

The Shetland, a combined effort of Shorts and Saunders-Roe, is one of the best boats ever produced. The untimely destruction by fire on her moorings at Felixstowe of the first Shetland prevented extensive operational trials being made, but sufficient tests had taken place before the mishap to show that the machine handled very well both on the water and in the air. Having been designed initially for military work, the hull is not, perhaps, quite ideal for passenger work, but at that it is better than many a landplane fuselage in its roominess and general comfort possibilities. With a still-air range of 3,000 miles the pay load is ten tons at a cruising speed of 185 m.p.h. The speed is not spectacular, but the boat is so comfortable that passengers will arrive quite fresh at the end of a slightly longer flight time.

There is no question that a large percentage of travellers prefer the flying-boat. The trouble is that the operators will not use this type of aircraft, or in other words will not give the traveller what he wants. We do think the possibility of using the already existing components for completing the limited number of Shetlands deserves the most careful examination. In addition to being very useful on the Atlantic route, these boats would serve to give operational experience in preparation for the even larger Saro boat now being built, which will not be ready until 1950 or so.

Helicopter Limitations

THERE are times when those who were connected with or interested in flying in its early days sigh regretfully at the recollection of the relative simplicity of the flying machines of that period, compared with present-day complexity (perplexity might almost be a better word).

In fixed-wing aircraft the problems which face the designer of high-speed machines are complicated and full of unknown factors. But helicopter design is even more

confusing because of the many variables involved. Dr. J. A. J. Bennett explained some of the fundamental limitations in his recent lecture to the Philadelphia Forum of the American Helicopter Society, a summary of which is published in this issue

That the many problems will be solved, and the difficulties overcome, is not to be doubted, but it is well that they should be fully realized so that we in this country may avoid the over-enthusiasm which swept America a couple of years ago. No good purpose is served by "overselling," to use an American expression, the virtues of the helicopter. Once it has been developed into a flying machine which can be handled by the man of average skill, the helicopter will sell itself—if the price can be reduced.

The Silent Navy

GENERAL complaints were voiced in the Debate on the Navy Estimates about the meagreness of the information given, and indeed they were well justified. The searcher after information concerning naval aviation, for instance, found little to enlighten him. The Memorandum did disclose that one man in four is concerned therein, that carriers are second to none in naval importance, and that "provision for naval aviation features large in the total financial provision"; but that was all.

If one examines the Estimates closely one may find that naval air equipment is a portion of "Guns, torpedoes, mines, ammunition, etc.," being apparently the "etc.," but one is left to guess how much out of the £4,650,000 is for aircraft material. A slight further enlightenment is gleaned from Vote 8, in which Air Stores account for £2,900,000, described as including naval aviation stores, and spares for airframes and engines. Training is expected to cost £500,000.

The Debate did not succeed in eliciting very much more information. Mr. John Dugdale, the Parliamentary and Financial Secretary to the Admiralty, referred to the large number of operations from carriers, and said that 23 airfields and air establishments at home and abroad were in commission, and that some 22,000 men and women are employed on shore jobs. He added that some 2,500 air category officers and ratings are engaged on duties connected with flying.

Mr. Paget, who spoke at length, delivered the dictum that "a battle fleet which cannot fly is obsolete"; and Mr. Brendan Bracken thought the House could profitably give a full day to the consideration of all aspects of the naval aviation branch.

Mr. Walter Edwards, the Civil Lord of the Admiralty, disclosed the great secret that aircraft types in use at present are: The Seafire, Sea Fury, Sea Hornet and the Firefly. That information will doubtless be greedily snapped up by any potential enemy of this country!

Altogether the Estimates were disappointing, and they were followed by a not very brilliant Debate.

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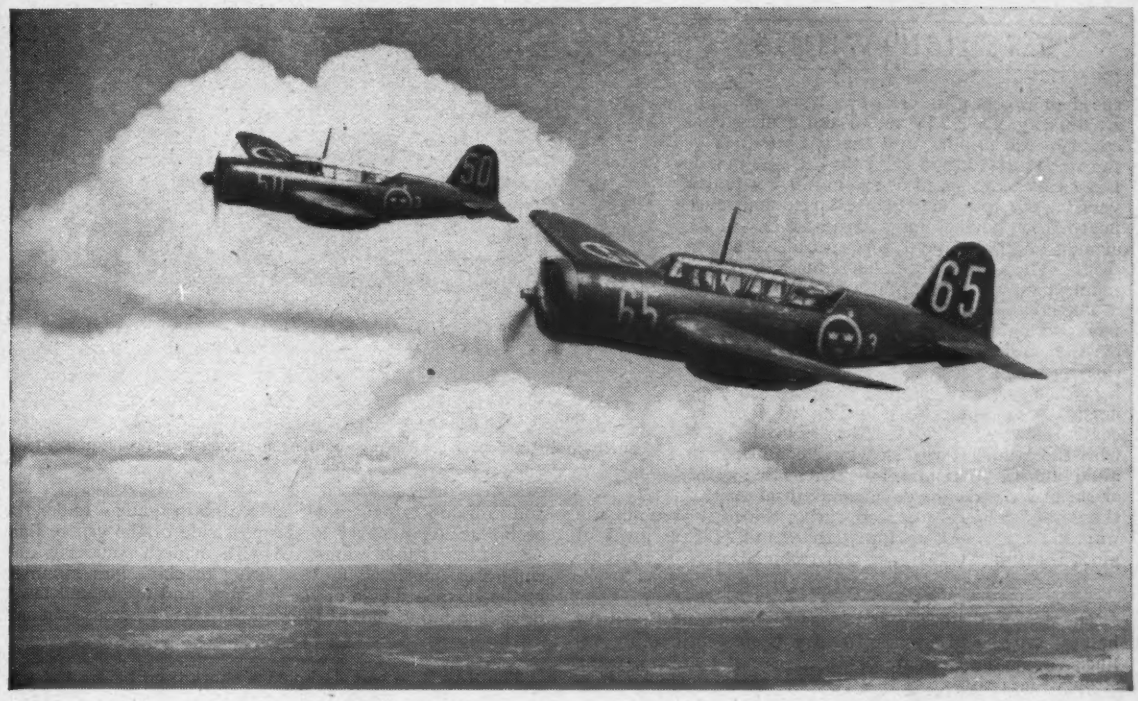
HOSTS AND GUESTS: Delegates of the Supreme Soviet of the Union of Soviet Republics chat with their hosts, including the Secretary of State for Air and the Chief of Air Staff, while awaiting F/O. Carter in a Vampire. The scene is at Halton. An account will appear next week.

"Flight" photograph.



Two SAAB-17B dive-bomber and reconnaissance aircraft. The 17B has Bristol Pegasus XXIV engines.

SWEDISH WINGS

An Account of the Wartime Activities of the Svenska Aeroplan Aktiebolaget

By W. GREEN

DURING the war years, when the major combatant powers were concentrating vast effort on warplane production, Sweden's aircraft industry also experienced a very rapid expansion. With her previous channels of supply severed, Sweden found that she would not only have to build her aircraft but also design them. Thus, through necessity, the Swedish aircraft industry produced a number of original designs which have been continually improved throughout the last six years until they now equal or surpass many foreign designs of similar power.

The predominant aircraft manufacturing company in Sweden is the Svenska Aeroplan Aktiebolaget, the name of which is usually abbreviated to SAAB. The company was founded in 1937 for the manufacture of airframes and aircraft engines, with factories at Linköping and Trollhättan. When the need came for Sweden to produce her own aircraft, SAAB undertook the manufacture of a number of all-metal military aircraft of its own design. Previously, the concern had produced the Junkers Ju 86K twin-engined medium bomber, the Northrop 8A-1 dive-bomber, and the North American NA-16-4 advanced trainer under licence. With experience gained from the manufacture of these, original designs were evolved which now form the bulk of Sweden's air arm.

The SAAB-17

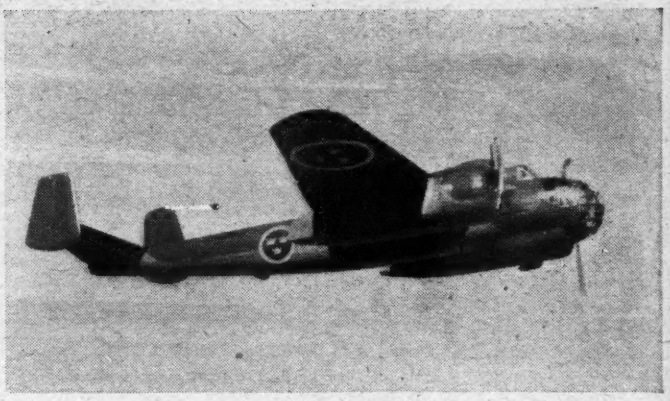
The SAAB-17 was the first bomber entirely designed in Sweden. Design work was begun in 1938 at the Förenade Flygverkstäder, a company then controlled by SAAB. It was intended for use as a reconnaissance monoplane, but a year later the specification was altered to incorporate the duties of dive-bomber. About this time, SAAB took over control of the aircraft division of the Aktiebolaget Svenska Jarnvägsverkstäderna, with the result that the activities of the Förenade concern were discontinued, and the necessary design changes on the SAAB-17 were carried out at SAAB's newly acquired Linköping plant. The prototype powered by a Pratt & Whitney radial engine, flew for the first time on May 18th, 1940. The SAAB-17 is a two-seat dive-bomber/reconnaissance monoplane and has been produced in four basic versions, three of which differ merely as regards the engine installed: 17A has a 1,065 h.p. Pratt & Whitney Twin Wasp SC3-G two-row radial engine and a maximum

An SAAB-17 in seaplane form with cantilever floats.

SWEDISH WINGS

speed of 275 m.p.h. The 17B has a 980 h.p. Bristol Pegasus XXIV radial and a maximum speed of 246 m.p.h.; and the 17C powered by the 1,000 h.p. Piaggio P.XI bis R.C.40D radial, has a maximum speed of 270 m.p.h. A fourth version, the 17BS, is a two-seat reconnaissance floatplane, having large twin-floats, a rearranged cockpit layout, and specialized equipment. The addition of floats reduces the maximum speed to 215 m.p.h.

The bomb load is carried in a fuselage bomb-bay and on racks under the wings outboard of the undercarriage fairings. The undercarriage units are raised backwards, and each leg, when retracted, is totally enclosed in large fixed fairings under the trailing edge of the centre section. The SAAB-17 was designed with the arduous Swedish winter conditions in mind and has, therefore, interchangeable wheel or ski undercarriage. A substantial number of these aircraft were produced during the early years of the war and the SAAB-17 forms the standard equipment of most Swedish dive-bomber and reconnaissance squadrons.



The twin-engined SAAB-18A dive-bomber and long-range reconnaissance aircraft.

The SAAB-18

The design of the SAAB-18 was begun during the latter half of 1939, and has apparently been considerably influenced by the German Dornier series of bombers, being strongly reminiscent of the DO 215. First flown on June 19th, 1942, the SAAB-18 has been produced in large numbers and is now the standard Swedish medium-bomber. It is a three-seat twin-engined medium bomber or long-range reconnaissance monoplane, of which two versions have so far been produced: the 18A, equipped with two 1,065 h.p. Pratt & Whitney Twin Wasp SC3-G radials, having a maximum speed of 289 m.p.h., and the 18B, test-flown for the first time on June 10th, 1944, and powered by two 1,475 h.p. Daimler Benz DB 605B in-line engines, giving a maximum speed of 355 m.p.h.

The bomb load of the SAAB-18 is stowed internally and on racks under the wings. Retractable, slotted-type dive-brakes are fitted outboard of the engine nacelles, and these lie flush with the wing when retracted. The bomb aimer is positioned in the glazed nose of the fuselage, and the pilot and radio operator/gunner are seated in tandem under the cockpit canopy, offset to the port side of the centre line. Armament is light compared with modern standards and comprises one fixed forward-firing machine gun mounted in the starboard side of the fuselage, and upper and lower flexible gun positions at the rear of the crew's compartment.

The SAAB-19

The SAAB-19 was designed a short time before the war for production should the Swedish air force fail to obtain single-seat fighters from abroad. As a number of Republic EP-1 fighters were acquired from the U.S.A., it was decided to abandon continued development of the project. The SAAB-19 was to have been powered by a modified Bristol Taurus radial developing 1,215 h.p. With this engine, the maximum speed was estimated at 375 m.p.h.

The SAAB-21

An interesting and advanced Swedish fighter design is the SAAB-21 single-seat pusher monoplane, which flew for the first time on July 30th, 1943. The SAAB-21 is of twin-boom layout with the pilot's cockpit positioned in the central nacelle above the leading edge of the wing. The obvious advantages of this formula are the good view

Unorthodox in its layout the SAAB-21 is a twin-boom, single seater fighter with pusher airscrew. It has an ejector seat for emergency use.

SWEDISH WINGS

obtainable from the pilot's cockpit and the concentration of fire-power achieved by placing the complete armament in the nose of the nacelle. Previous aircraft built to this layout have had the inherent disadvantage of being all but impossible for the pilot to escape from with safety in cases of emergency. The SAAB concern have surmounted this difficulty by fitting the SAAB-21 with gunpowder catapult ejection gear which throws the pilot and seat clear of the airscrew disc after detaching the canopy. Powered by the 1,475 h.p. Daimler Benz DB 605B engine, the SAAB-21 has a maximum speed of 398 m.p.h., a cruising speed of 324 m.p.h., and a landing speed of 90 m.p.h.

It is planned to use a modified version of this machine, the SAAB-21R, as a flying test-bed for jet propulsion investigation using a de Havilland Goblin unit placed in a similar position to that on the Vampire. No major airframe modification is necessitated, and providing prototype trials are completed successfully, a number will be built to equip certain fighter wings. Experience gained from the SAAB-21R should prove useful in the design and construction of a new high-speed jet-propelled aircraft that is reported under development. This design, the SAAB-1001, will embody all the latest developments generally associated with high-speed flying, such as swept-back wings of laminar-flow section and is possibly a future contender for the world's air speed record. Flight trials are expected to begin towards the end of 1948, and the estimated maximum speed is in the region of 650 m.p.h.

(It is to be assumed that the 1001 will be powered by the de Havilland Ghost jet engine, which gives 5,000 lb static thrust and is only of 3in greater diameter than the Goblin. —ED.)

The SAAB-23 and 24

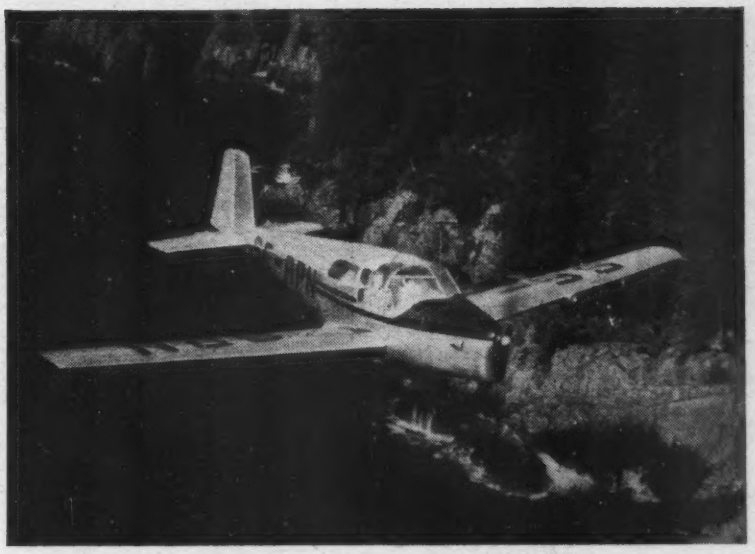
The SAAB-23 was developed as an alternative design should the SAAB-21 prove unsuccessful. The 21, however, came well up to expectations and therefore development of the 23 was discontinued. Not unlike the early North American Mustang in layout, the SAAB-23 was intended to use the catapult seat ejection gear similar to that installed in the SAAB-21 and was to have been powered by the same motor, the DB 605B. The estimated maximum speed was 390 m.p.h. at 20,000 feet.

The SAAB-24 was intended for use as a night fighter and to replace the SAAB-18A on the production lines. When the latter machine was repowered with DB 605B engines, with a resulting increase in performance, it was decided not to produce the SAAB-24, the slight gain in performance over the 18B not being considered worth the trouble of changing production lines and tooling-up for the new type. The SAAB-24 project, popularly known as the Swedish Mosquito, was designed to mount two DB 605B engines and to have a maximum speed of 392 m.p.h. at 22,000 feet.

Until 1945, the demand for warplanes for the Swedish rearmament programme confined SAAB to the design and manufacture of entirely military types. However, now that the needs of the air force are less pressing, the company has commenced the production of two civil projects, the *Scandia* and the *Safir*.

The SAAB-90 Scandia and the SAAB-91 Safir

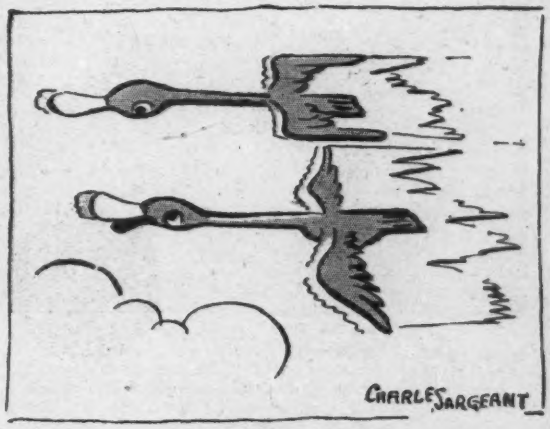
The SAAB-90 *Scandia*, the largest aircraft so far built in Sweden, is a twin-engined all-metal transport aircraft to be produced both as a 24-seater and as a 32-seater. Reminding one strongly of the ubiquitous DC-3, the Scandia is a cantilever low-wing monoplane of monocoque construction. A retractable tricycle undercarriage is fitted and the machine is powered by two Pratt & Whitney 2SD13-GR-2000-13 radial engines developing 1,450 b.h.p. for take-off. The estimated performance is: Maximum speed, 251 m.p.h.; cruising speed, 222 m.p.h.; service ceiling, 27,800 feet; rate of climb from sea level, 1,200 ft per min.



Intended for the private owner or for training purposes the Safir is a three-seater all-metal cabin monoplane.

The SAAB-91 *Safir* (Sapphire), which flew for the first time on November 20th, 1945, is a three-seat all-metal cabin monoplane intended for the use of the private owner and the flying-club. Other possible applications include those of dual-control trainer or ambulance with accommodation for one stretcher. The *Safir* is powered by a 145 h.p. de Havilland Gipsy Major X, and has the following performance: Maximum speed (at 2,350 r.p.m.) 158 m.p.h.; cruising speed (at 2,100 r.p.m.) 140 m.p.h., stalling speed 50 m.p.h., range 650 miles, take-off run from grass runway with no wind, 590 feet.

The design of some of the afore-mentioned aircraft is well up to the standard set by contemporary foreign aircraft of similar power and this fact reflects much credit upon the resourcefulness of the Swedish designers who have successfully overcome the difficulties of Sweden's limitations in materials during the war. It is likely that the next few years will see a number of very advanced designs emanating from the factories at Linköping and Trollhättan.



"Duff Forecast Eh?"

HERE AND THERE

Decca in America

AN American subsidiary of the Decca Navigation Co., Ltd., Decca Navigator System, Inc., has applied to the Federal Communications System for an experimental licence to conduct tests on guiding aircraft and ships into the New York area. If permission is given, the trials could begin in about six months, and the idea would be to establish a master station at Yorktown, N.Y., with three slave stations in the region. These would serve an area bounded by Buffalo, Pittsburg, Boston and Washington.

Under Licence

FOLLOWING the announcement that they are to build Sikorsky helicopters in this country, Westlands have acquired one S-51 for experimental and research purposes.

On a flight test of this aircraft the chairman of Westlands, Lord Aberconway, who happened to be visiting the United States, was the first passenger.

The Rateau on Test

THE Rateau S.R.A.-1 jet unit familiar to many from the Paris Aero Show has been undergoing endurance tests. At a weight of 2,200 lb it develops a static thrust of 2,200 lb at a speed of 7,500 r.p.m. Consumption is said to be 1.05 lb of fuel per hour per lb thrust. The Rateau metallurgical laboratories have been working on new austenitic steels for turbine blades, and our contemporary *Les Ailes* states that although at a temperature of 750 deg this material is slightly inferior to the British Nimonic 80 (which is considered the best for the purpose) at 800 to 850 deg, the new Rateau steel is superior. It is claimed that with the new metal it is possible to increase the operating temperature by 75 deg and that, by running at 8,500 r.p.m., the static thrust is increased to some 3,000 lb.

AFTER THE FLIGHT: Igor Sikorsky and the Rt. Hon. Lord Aberconway (left and right centre) in front of the Westland Sikorsky at Bridgeport U.S.A. Left is J. M. Barr, export manager U.A.C. and, right, B. L. Whelan, general manager Sikorsky Div. United Aircraft Corp.

To Belfast from Rochester

A REPRESENTATIVE from *Flight* recently accompanied Mr. Brooke-Smith, one of Short's test pilots, on a Solent boat flying from the Medway to Short and Harland's aircraft factory at Belfast.

Sitting in the second-pilot's seat, he obtained this photograph, which shows so clearly the splendid layout of the first-pilot's instrument panel. The actual figures on the instrument dials must not be taken too seriously because only hack engines were fitted for the journey.

"Flight" photograph.

The Solent is shown to be in level flight and doing 160 knots at 1,800 r.p.m. at 4,550 ft. (True airspeed 193 m.p.h.) Boost gauges indicate 31 inches of mercury. The outside temperature is just a degree or so above freezing. Not a standard fitting, the sweet bag contained peppermint drops.

HERE AND THERE

Freighter's Tour

THE Bristol Freighter G-AIMC which, as recorded in our issue of March 20th, is on its way to Australia and New Zealand on a demonstration tour, had to leave without Capt. Bartlett, who was on board from Bristol to Hurn, but was taken ill and had to leave the machine and return to Bristol. We are glad to be able to report that Capt. Bartlett is now a good deal better and hopes to catch up the Freighter in Australia some time in May.

Sandringhams in Norway

D.N.L., Norwegian Airlines, internal services with Sandringham flying-boats are about to start operations. One is expected early this month, and the company are hoping for delivery of the other two in about three or four weeks' time. The Sandringhams are Mk. VI, powered by Pratt and Whitney Twin Wasps and seat thirty-seven passengers. Two flying-boats will be used each day on the route Stavanger, Bergen, Oslo, Trondhiem, Bronnoysund, Bodo, Harstad and Tromso, one flying in each direction. The third aircraft will be reserved for charter work, and the company expect to do considerable business with shipowners, who often need ships' crews flown to various ports at short notice.

Courtesy Visit

THE Royal Dutch Navy's aircraft carrier *Karel Doorman* is to visit London on the Admiralty's invitation from April 14th to 19th. The *Karel Doorman*, before being handed over to the Dutch Royal Navy, was the *Nairana*. During the visit Admiral C. E. L. Helfrich, C.-in-C. Dutch Naval Forces, will receive a cheque towards replanting trees on the island of Walcheren which was flooded during the war partly by the Germans and partly by R.A.F. bombing of the sea dykes.

British Gliding Air Awards

THE cups and trophies shown in the photograph at the top of this page are for annual competition, and the following are the holders for 1946: The de Havilland Cup for greatest height, P. A. Wills, 15,247ft. Manio Cup for best goal flight, P. A. Wills, 113 miles. Wakefield Trophy for longest distance, Prince Birabongse Bhanubadth, 184 miles. Volk Cup for best out and return flight, H. Kendall, 58 miles. Seager Cup for best two-seater performance, Lt. Cdr. (A.) J. S. Sproule and Lt. (A.) J. Suthers, 103 miles. There were no National Competitions held in 1946, and the Du Garde Peach Trophy for the best club team, and the Firth Vickers Trophy for the best performance by a British pilot in a British-designed and -built sailplane, were not awarded.

WORTH GLIDING FOR: The British Gliding Association's cups and trophies. Left to right (top) Firth Vickers Trophy, Manio Cup, Seager Cup. (Bottom) De Havilland Cup, Wakefield Trophy, Du Garde Peach Trophy and the Volk Cup.

Two Million Modellers

IT is estimated that there are about two million aeromodellers in Great Britain. The figure is increasing rapidly and there are already many "diesel," or more strictly compression-ignition, enthusiasts. Over a dozen British firms are manufacturing these little engines for flying models.

R.Ae.C. Officers

THE following are the elected president, vice-presidents and committee members of the Royal Aero Club, who will serve for the year 1947-48.

President.

The Rt. Hon. Lord Brabazon of Tara, M.C., P.C.

Vice-Presidents.

Capt. Sir Geoffrey de Havilland, O.B.E.; Sir W. Lindsay Everard; Lord Gorell, C.B.E., M.C.; The Marquess of Londonderry, K.G., P.C., M.V.O.; Lt.-Col. Sir Francis K. McClean, A.F.C.; Sir Frederick Handley Page, C.B.E.; The Duke of Sutherland, K.T.

The Committee.

Capt. K. J. G. Bartlett; A. V-M. John N. Boothman, C.B., D.F.C., A.F.C.; Capt. H. S. Broad, M.B.E., A.F.C.; S. Kenneth Davies; Col. W. C. Devereux; Francis Francis; G/C. T. Loel Guiness, O.B.E.; Capt. A. G. Lamplugh, C.B.E.; Maj. R. H. Mayo, O.B.E.; G/C. G. H. M. Miles; H. W. H. Moore; Maj. H. A. Petre, D.S.O., M.C.; Maj. J. Stewart, O.B.E.; Whitney W. Straight, C.B.E., M.C., D.F.C.; C. F. Uwins, O.B.E., A.F.C.; G. H. Wilson-Fox; Frank Woodhead; W/C. Norman H. Woodhead, D.S.C., A.F.C.

House Committee.

W/C. J. R. Ashwell-Cooke, M.B.E.; Capt. H. S. Broad, M.B.E., A.F.C.; Lt. Cdr. J. G. Crammond; Capt. E. Keith Davies; Lt. Cdr. R. G. Kent; G/C. G. H. M. Miles; Maj. J. Stewart, O.B.E.; Lawrence Swan; W/C. Norman H. Woodhead, D.S.C., A.F.C.

Meteor Trainer

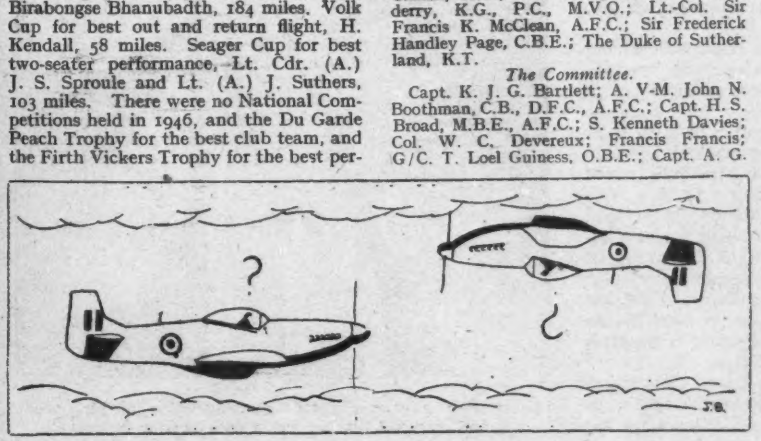
A DUAL-CONTROL version of the Gloster Meteor has been designed for training in high-speed flight and aerobatics. Derwent V power units are fitted and the maximum speed is 585 m.p.h. The initial rate of climb is 8,170 ft/min and the endurance at 30,000ft, 1.4 hr. Full equipment is installed in the pupil's cockpit, but the instructor has only essential instruments. More details will appear next week.

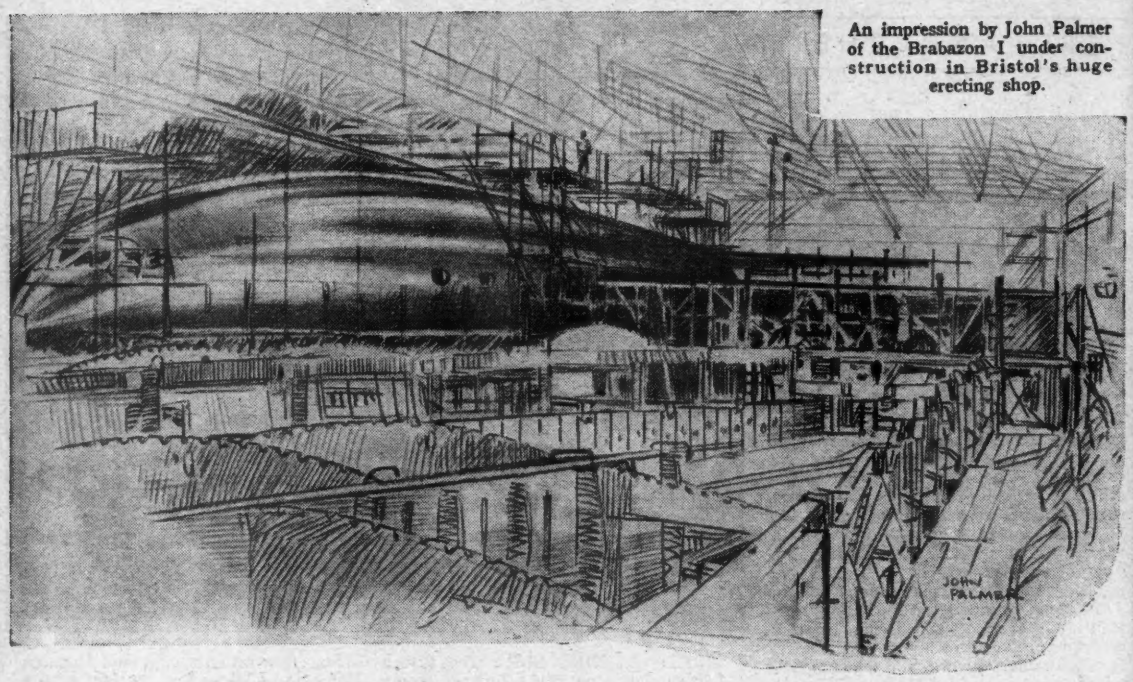
Congratulations

IT will probably be a surprise to most of our older readers that Mr. G. H. Handasyde celebrated his 75th birthday last Sunday, March 30th. He was the designer of the famous Martinsyde aeroplanes built before and during the first world war.

H. A. Taylor's New Post

AIRSPEED, LTD., announce the appointment of Mr. H. A. Taylor to the post of chief executive in charge of all public relations matters. He will be stationed at Christchurch, where the Ambassador is being built. Many articles by H. A. Taylor have appeared in this journal during the last ten years or more, and readers will recall the recent series describing a flight to India with a R.A.F. Navigation Liaison Mission.





An impression by John Palmer of the Brabazon I under construction in Bristol's huge erecting shop.

The Brabazon I

Part II—Structure of Tail Surfaces and Mainplane Described : Pressurization Problems Solved

(*Concluded from page 266*)

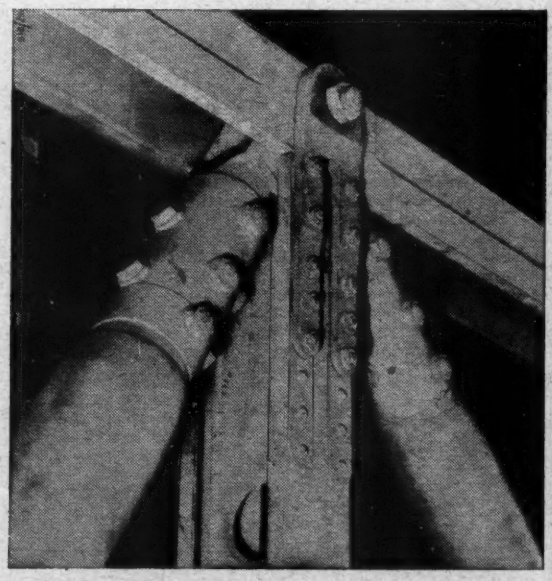
FOUR frames aft of this last bulkhead is a U-frame picking up with the tailplane front spar. The web of the U is a diaphragm, to the outer edge of which solid square-section extrusions are fitted on each side and are strapped to an L-extrusion which forms the bottom contour member. A rather similar arrangement holds for the inner profile of the U although the scantlings are somewhat lighter. A point is that the heavy rectangular-section extrusions on the inner profile are tapered upward as wedges to form a scarf joint with two massive posts, at the top ends of which are lugs for picking up the feet of the fin rear spar.

A further U-frame picks up to the tailplane rear spar, the inner and outer profile members being L-extrusions which are fitted on the rear face. The tail cone of the fuselage aft of the tailplane rear spar is supported on two U-frames of light channel section.

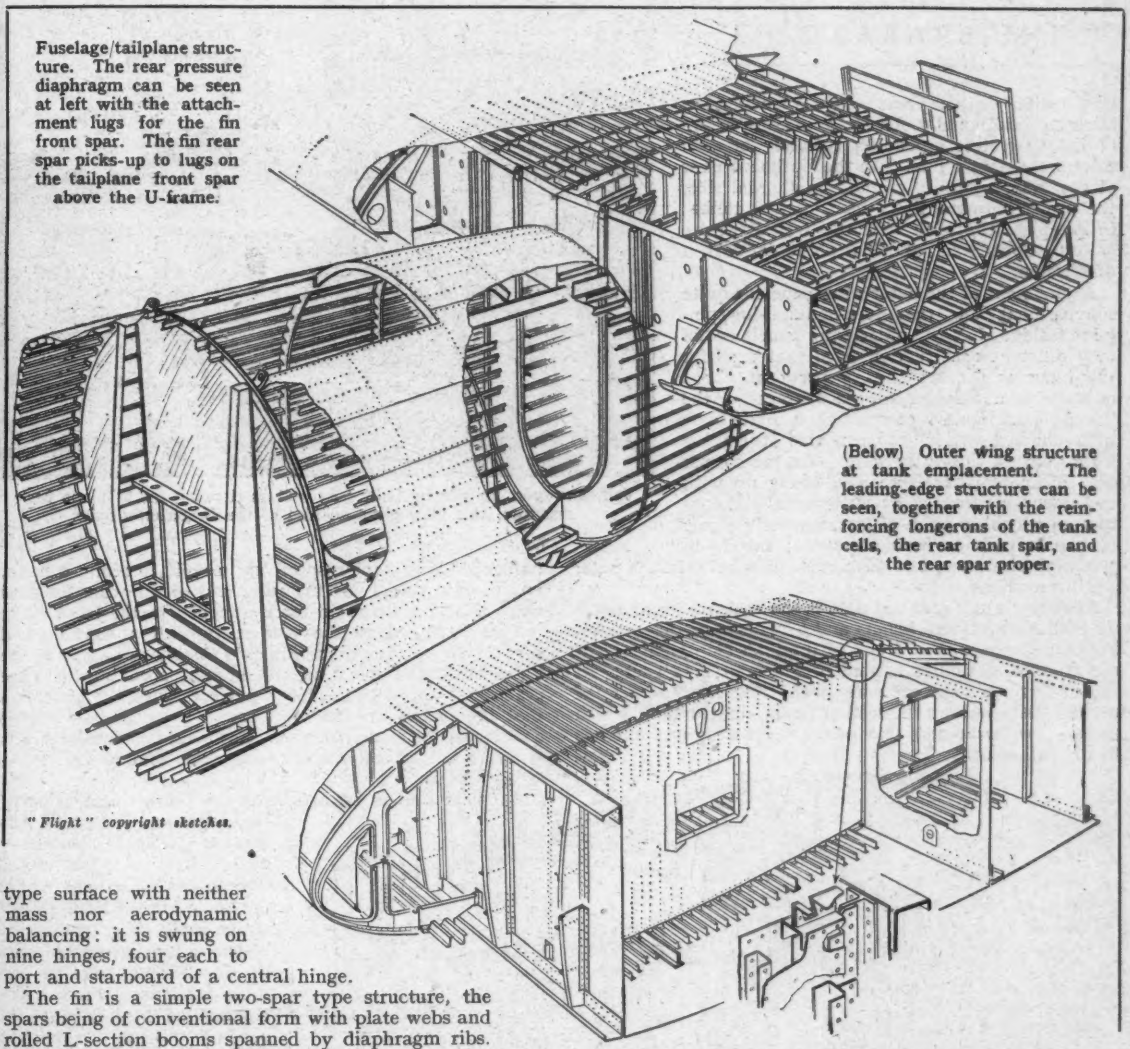
This completes the basic structure of the fuselage, but whilst in this region and having just referred to the tailplane and fin spars we might survey these surfaces before dealing with the main wings.

The tailplane spars are both diaphragm type with solid rectangular-section extruded booms taper-machined to thin wedge-ends about 10ft outboard of the central axis; from this point to the tips the booms are heavy pressings. The plate web of the front spar is broken on the centre line and joined with a doubling plate, the booms being correspondingly joined by shackle straps. Inter-spar girder ribs have light channel-section contour members braced by tubular W-strutting and are notched for the spanwise Z-section stringers. The same Vee-blending system as used in the fuselage is employed here, the number of stringers progressively diminishing towards the tailplane tips.

Elevators are built up on plate-web spars with rolled angle-section booms, and employ diaphragm ribs which are spanned by L-section extruded stringers. The leading-edge nose is a D-form box structure, the inboard end of the box being used as a torque tube for elevator operation, although from a stress case aspect all torque is taken out in the three innermost ribs. Each elevator is a plain symmetric flap-



Inner wing front-spar detail, showing union of king post and diagonal bracing struts with the top boom.



Fuselage/tailplane structure. The rear pressure diaphragm can be seen at left with the attachment lugs for the fin front spar. The fin rear spar picks-up to lugs on the tailplane front spar above the U-frame.

(Below) Outer wing structure at tank emplacement. The leading-edge structure can be seen, together with the reinforcing longerons of the tank cells, the rear tank spar, and the rear spar proper.

"Flight" copyright sketches.

type surface with neither mass nor aerodynamic balancing: it is swung on nine hinges, four each to port and starboard of a central hinge.

The fin is a simple two-spar type structure, the spars being of conventional form with plate webs and rolled L-section booms spanned by diaphragm ribs. As we have seen, the raking front spar picks up to the head of the fuselage rear pressure diaphragm, whilst the rear fin spar (which is also slightly raked) attaches to the top of the tailplane front spar. The rudder is of identical structural form to that of the elevator.

Wing/Fuselage Pressure Joint

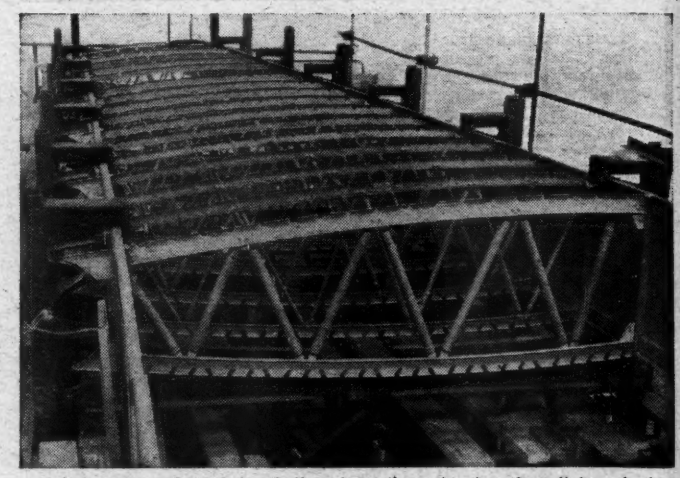
Joining of the mainplane centre-section with the fuselage presents quite a novel solution of the fairly difficult problem of ensuring adequate sealing of the fuselage internal pressure. As already mentioned, the centre-section is built as a continuous structure which passes directly through the fuselage, the front and rear spars in their spanning portions being formed with diaphragm webs to function as pressure bulkheads. The upper and lower centre-section skin surfaces are also continuous through the fuselage, and in order to make the wing interior a pressurized compartment extra skins are applied to the "free" flanges of the centre-section stringers. These internal skins are riveted at their outer edges to angle members, the vertical flanges of which are in turn riveted to diaphragms known as "wing root ribs," these latter being, in essence, continuations of the fuselage skin through the wing. Thus, a cross-section of the fuselage at this station shows a pressurized compartment above the wing, a pressurized compartment inside the wing, and a pressurized compartment beneath the lower wing surface, the cavities between these three allowing the passage of the centre-section stringers.

Outboard of the fuselage, the centre-section front spar is a girder-type structure, the bottom boom being of π-section (made up of two T-sections placed side by side) whilst the top boom is a channel-section, these several members all being very hefty extrusions. Inter-boom bracing is by king post stanchions of a massive extruded section, resembling two channels placed back-to-back with a central spine flange, and tying these king posts together are equally substantial diagonal bracing struts of tubular steel. Behind the two T-extrusions making up the front spar bottom boom is a further extruded T-section reinforcing boom.

By comparison, the rear spar is a simple structure comprising a diaphragm web with massive extruded L-section booms. Here again, in front of the bottom boom is an extruded T-section reinforcing boom to complement that of the front spar bottom boom.

Chordal ribs are fabricated warren-girder type components, with tubular struts of Hiduminium bracing the contour members. These members are made up with sheet webs, the internal edges of which are reinforced with Z-section extrusions, whilst the outer edges carry T-section extrusions; the latter are machined away together with the sheet webs to afford passage for the Z-section spanwise stringers to which the skin is attached. Those chordal ribs bounding the undercarriage bay are of diaphragm type with extra large stabilizing members, and on the centre line of the bay the front spar king posts are doubled. In

THE BRABAZON I

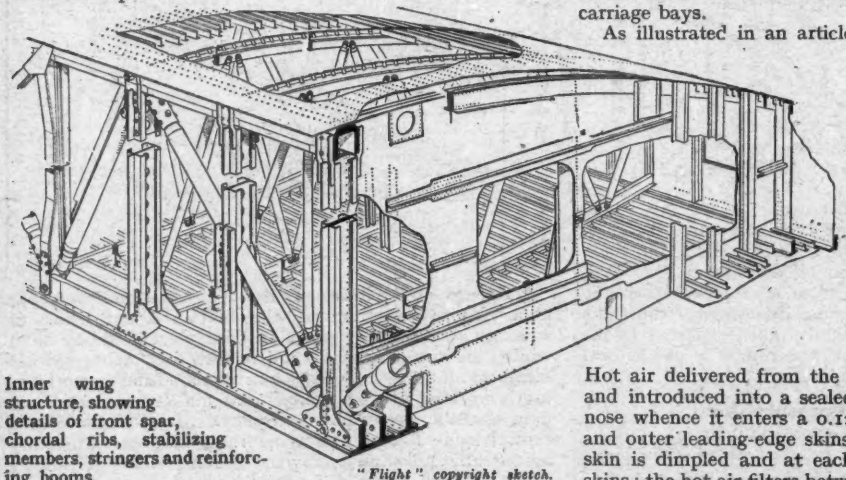


Tailplane (port half) being built. As well as showing the tailplane basic structure, this view gives an idea of the Brabazon's scale.

this region on the rear spar, a reinforcing boom is additionally fitted to the top boom of the spar, this extending 10ft 6in on each side of the centre line. At the outboard ends of the inner wing are diaphragm chordal ribs, the space between them housing fuel tanks; to complete the tank cell, the web structure of the front spar at this point is also a diaphragm.

Attachment of the outer wing panels is quite conventional in the fork-end-and-lug/pin-joint fashion, but the outer wing panels are of very different construction from that used for the inner wing. At the 15 per cent chord ordinate is a diaphragm-type spar called the "front tank spar" comprising a plate web with channel-section booms: this forms the front spar of the outer wing. At the 27 per cent ordinate (that is to say, lining up with the inner wing front spar) is the front spar continuum which, in point of fact, is merely a pair of booms with no web structure; this is to give tank clearance, and distribute stress between the outer and inner wings.

At the 55.2 per cent ordinate is the tank rear spar made up with conventional booms and a plate web, this extending only to the outboard end of the tank emplacement; its construction is similar to that of the front tank spar. At the 68.807 per cent ordinate is the rear spar proper, of normal plate web and L-section boom construction, which picks up with the rear spar of the inner wing and extends to the full span.



Inner wing structure, showing details of front spar, chordal ribs, stabilizing members, stringers and reinforcing booms.

"Flight" copyright sketch.

Fuel tanks are in twelve main units in each outer wing panel, and they are spaced by dividing ribs formed with two diaphragms enclosing a central cavity in which are vertical channel-section stabilizers; the contour members of these ribs are of spine-flanged channel-section. As previously noted, two extra tanks are fitted in the outboard ends of the inner wing.

Just as the quality of skinning and the close tolerance of the skin panel thickness applies to the fuselage, so it also applies to the skin plating of the wings. For similar reasons of stress/weight factors, skin thickness is graded spanwise and chordwise, the heaviest gauge being employed around the centre-section, each panel outboard being reduced in gauge. Of the three panels at each chordal section, that attached to the front spar is the heaviest. Considering the skinning in some degree of detail, the centre-section is plated with sheet 0.185in thick, successive outboard skins being respectively 0.176in, 0.166in, 0.144in, and 0.125in thick. At the outer end of the wing the final three panels are 0.125in thick attached to the front spar; 0.095in attached to the rear spar, with a centre panel 0.116in thick. The preceding skin thicknesses apply to the upper surface of the wing, but broadly speaking the same gradations apply to the lower surfaces with the exception that the panels are, in most cases, a gauge below their counterpart on the top surface; however, compensating this is the use of extensive reinforcing skins around the undercarriage bays.

As illustrated in an article on the power installation of the Brabazon ("Duplex Airscrews," *Flight*, December 26th, 1946) the four twin-Centaurus XX power plants are housed in the leading edge of the inner wing. Outboard of the outermost engine cells in the leading edge of the inner wing are twin surface-combustion heaters, each of 400,000 b.t.u. capacity, which feed outward into ducts incorporated in the leading edge of the outer wing for thermal anti-icing. Hot air delivered from the heaters is fed through elbows and introduced into a sealed chamber in the leading-edge nose whence it enters a 0.128in cavity between the inner and outer leading-edge skins on the nose line. The inner skin is dimpled and at each dimple a rivet attaches the skins; the hot air filters between the skins and escapes rearward at top and bottom into the inter-spar space of the wing, to be exhausted to atmosphere between the ailerons and flaps. The leading-edge skins are carried on open ribs and, as a structure, the leading edge is divided spanwise by a diaphragm, forward of which is the thermal duct. The tailplane leading edge is of precisely similar construction.

Ailerons have a reflex curved top contour and are pure flap-type surfaces without balance of any form. They are fabricated as two-spar structures, the front spar having a plate web with rolled channel-section booms, whilst the rear spar is simply a channel-section member. Chordal ribs are diaphragm type spanned by beaded L-section stringers. Each aileron is swung on eight hinges which, in common with all the hinges used for control surfaces, are self-aligning barrel-type needle-roller bearings.

Flaps are plain type full trailing-edge section surfaces hinged on the forward edge of the lower surface, those on the inner and outer wing being separately actuated.

HELICOPTER DESIGN

Limitations Imposed by Basic Problems Still Awaiting Solution : Torque, Vibration and Stability

RECENTLY we recorded the departure for America of a small helicopter mission which includes G/C. Liptrot, Dr. Bennett, W/C. Brie and Mr. Whitby, of British European Airways. At the Helicopter Forum held in Philadelphia on March 27th, 28th and 29th, Dr. Bennett presented a paper entitled "Limitations in Helicopter Design." It is, in the main, a repeat of his recent lecture to the Helicopter Association of Great Britain, and the main points are summarized below. The lecture serves a very valuable purpose in setting out the main problems which still have to be solved before the helicopter is the stable simple-to-fly aircraft which we hope it may become some day.

Dr. Bennett began by saying that, in spite of the fact that the helicopter has become a vehicle of practical utility, we still had a long way to go in the investigation of the basic problems of rotary-wing flight. Fortunately, due to the work of Juan de la Cierva, there was available a background of experience which helped in the appreciation of the inherent limitations which still impede progress in helicopter development.

The Flapping Hinge

No other single feature had contributed more towards the achievement of practical rotary-wing flight than did the flapping hinge. Although at first it had been regarded as a means for suppressing vertical bending at the blade roots, it became of primary importance for single-rotor aircraft in balancing the dissymmetry of lift in forward flight. The original intention was that the flapping hinge should permit the blades to adopt at every instant the position required for equilibrium between the centrifugal force produced by the speed of rotation and the lift due to the action of the wind on the blade. This intention was, however, frustrated by the inertia of the blade.

Inertia imposed a natural oscillation (like that of a pendulum) on the motion of the blade about the flapping hinge. The natural frequency of this oscillation was equal to the speed of rotation. The periodic disturbing force due to the dissymmetry of forward flight had the same frequency, and was, therefore, in resonance with the natural flapping oscillation. When such resonance occurs, there is a phase lag between the disturbing force and the resulting displacement of exactly 90 deg. Thus in a gyroplane the flapping displacement of the blade was greatest after it had passed the nose of the machine, although the position of maximum lift was on the advancing side of the rotor disc. The tip path, instead of tilting laterally due to dissymmetry of forward flight, was tilted mainly longitudinally. Flapping, therefore, exchanged rolling of the aircraft for pitching. This phase lag had been a basic limitation in rotary-wing design, affecting adversely control response and, by inducing longitudinal dissymmetry in forward

By J. A. J. BENNETT,——
——M.A., D.Sc., Ph.D.

flight, affecting also stability, trim and rotor vibration.

The terms flapping, hunting and feathering defined the angular oscillation of the blade about the mutually perpendicular axes. Flapping was the angular oscillation about a pivot which allowed the zenithal angle of the blade to be varied; hunting was the angular oscillation about the drag hinge which allowed the blade to be displaced angularly in aximuth with respect to the rotor head; and feathering was the angular oscillation of the blade about a pivot, the feathering hinge, which allowed the blade angle to be varied.

In flapping, the blade rose and fell cyclically, thereby causing a variation in incidence, i.e., cyclic feathering. As flapping was a method of providing cyclic feathering, the same thing could be achieved by the feathering hinges.

Tilting of the tip-path plane caused a cyclic force tending to oscillate the blade in aximuth; hence the need for a drag hinge, which relieved the blade root from periodic bending moments. Giving each blade an additional degree of freedom of oscillation had been responsible more than any other for vibration troubles. The hunting oscilation was unstable unless the freedom of movement of the blade about the drag hinge was restricted by damping. Hunting instability manifested itself as a violent rocking of the aircraft during starting or stopping of the rotor on the ground. With insufficient damping the oscillations could increase in amplitude sufficiently to cause severe damage, and the most disturbing feature of the instability was that it was self-excited. Hence the drag hinge, originally conceived as an insurance against blade fatigue, had become a potential instrument of self-destruction.

DR. Bennett, who is now head of the helicopter branch of the Fairey Aviation Co., Ltd., has had long experience with rotating-wing aircraft. He joined G. and J. Weir at Glasgow in 1930, and worked on jump-start Autogiros. After periods in the Army and Air Ministry he became chief technical officer at the Airborne Forces' Experimental Establishment at Ringway and then went to America, first as principal technical officer on the British Air Commission and afterwards as project engineer in charge of helicopter research, attached to the U.S. Army Air Technical Service Command.

Rigidly mounted Blades

These difficulties with hinged blades had led to investigations of rigidly mounted blades. In single-rotor aircraft the feathering hinge could replace the flapping hinge, but even in the absence of this the blade partially flapped owing to its flexibility. On the other hand, even in the absence of a feathering hinge the blade partially feathered on account of periodic twist within the blade itself. If rigidly mounted blades could be built with sufficient strength they would have a number of advantages, such as smoothness of operation, light control forces, improved dynamic stability, and elimination of sluggishness in control response.

From a cost point of view the two-bladed rotor was attractive, but it suffered from excessive vibration (bicyclic). The vibrations could, however, be rendered comparatively innocuous by isolating the rotor from the fuselage.

Torque Problems

Dr. Bennett next dealt with the single-rotor torque problem. In the Autogiro, which was airscrew propelled, the rotor was kept revolving by the fact that a large proportion of the rotor blade, acting as a windmill, absorbed sufficient energy from the air to propel the remainder of the blade. An alternative solution was the Gyrodyne, in which the greater part of the power was used for rotor thrust in vertical flight, the remainder being supplied to an airscrew mounted outboard for balancing rotor torque reaction. Similar in principle was the use of a small tail rotor, as in the Sikorsky. A limitation with this arrangement was the long transmission to the tail rotor.

Torque reaction could be avoided by driving each blade at or near the tip

HELICOPTER DESIGN

either by airscrews or by jets. The former suffered from high airscrew losses, gyroscopic couples, and power transmission problems; the latter from high fuel consumption. One could also visualize blade-tip rotors rotating epicyclically about the main hub axis, the propulsive thrust being obtained either from the additive torque of the epicyclic rotors or by inclining their tip-path planes in the direction of rotation of the main rotor.

Dr. Bennett pointed out that since, for a given value of tip speed, power loading and disc loading, torque increased as the cube of linear dimensions, the problem became rapidly worse with size and, unless torqueless rotors could be developed to a practical stage, the use of a single rotor was confined to relatively small machines.

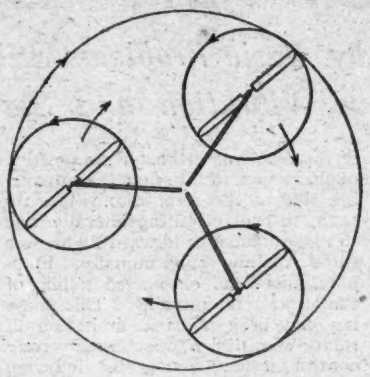
Limiting Power Loading

Turning to the question of power loading, the lecturer explained that the theoretical limit was $\frac{W}{P} = \sqrt{\frac{38}{w}}$, where the first term is the gross load per h.p. and w the disc loading of the rotor, in lb/sq ft. In practice, due to the fact that sustentation was caused by the downward acceleration of air by the rotor blades over an annulus of the disc and not over the whole disc, the induced power loading was reduced to about $\sqrt{\frac{33}{w}}$. The ground cushion might, however, enable an overloaded helicopter which was not capable of hovering at altitude to take off and land vertically within the ground cushion. The actual limiting power loading, taking profile drag into consideration, might be given approximately as $\frac{W}{E.H.P.} = \sqrt{\frac{25}{w}}$. For example, a rotor disc loading 2.3 should support between 16 and 17 lb/hp in hovering flight, at sea level but away from the ground cushion. The limiting power loading for a take-off with forward speed was nearly double that at zero forward speed.

Pitch Limitations

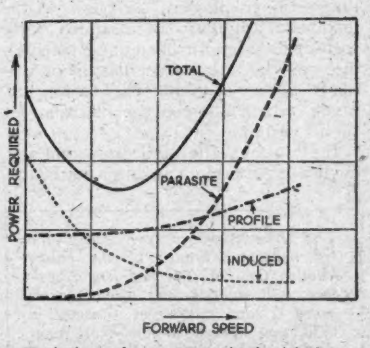
Variation in rotor pitch was required to vary the rotor power independently of angular speed; to compensate for the change of angle of attack of the blades due to variation in axial flow through the disc with forward speed; and to compensate for change of density with height.

In order to eliminate separate pitch or throttle controls, devices had been developed for governing pitch or engine speed. In the former there was an automatic pitch reduction in the event of power failure, and the consequent loss of lift before autorotation was established might cause the machine to land at excessive sinking



A possible helicopter layout with blade-tip rotors rotating epicyclically about the main hub axis.

speed. When automatic throttle control was fitted, the pilot retained control of pitch and could utilize the kinetic energy of the rotor for momentary hovering, but there was a risk of over-control in flight, the blades then slowing down and eventually stalling. The immediate reduction in pitch was essential in helicopters which operated at a pitch beyond that at which the blades would autorotate, but it was not necessary to take this risk at



Variation of power-required with forward speed. These curves show clearly the extra power needed to enable a helicopter to rise vertically.

all. The power could be absorbed equally well at low pitch by a rotor of low blade loading or high tip speed, except at very great altitudes.

A further high-pitch limitation was associated with the forward inclination of the rotor for propulsion. The disc then made a negative angle of incidence to the flight path, causing the axial flow through the rotor to increase with forward speed and changing the blade angle of attack unequally from root to tip. Least affected was the tip portion of the blade, and consequently when the mean collective pitch was increased to compensate for increased axial flow, the blade angle at the tip became excessive and might approach the stall cyclically at high translational speeds. The periodic variation at top speed not only impaired the propulsive efficiency but limited operation of the helicopter by the inherent roughness at the higher air speeds.

Limiting Translational Speed

Of maximum forward speed Dr. Bennett said that in view of the fluctuation in relative air speed and lift coefficient at the blade tip, bending and torsional deflections would be serious and would place a definite limit on forward speed. He did not think the speed of the tip of the advancing blade should exceed three-quarters of the speed of sound. For helicopters tip-speed ratios, i.e., the ratio of forward speed to tip speed, would be likely to remain at the Autogiro value of 2/3 for a long time to come. It had been suggested that this figure might reach a value of 1, but that would mean that the tip of the retreating blade would have zero air speed and the rest of the retreating blade would have negative air speed, and the lift of each blade would fluctuate from zero to its maximum value. This limitation would mean a maximum forward speed of about one-quarter of the speed of sound, or less than 200 m.p.h.

Dynamic Stability

Dynamic instability at zero forward speed, at one time thought to be a major limitation, was not now considered very important. The high position of the rotor ensured static stability. Dynamic stability was concerned with the subsequent motion; it was found that in certain present-day helicopters, where the period of oscillation was about 12 seconds and the time required to double the amplitude was 18 seconds, the unstable motion was not at all critical, nor difficult to control. Complete dynamic stability could be achieved if more than two-thirds of the oscillation of the tip-path plane were suppressed.

Technical Outlook

Dr. Bennett wound up by saying that it might be a long time before we had the perfectly stable, jet-driven hingeless, two-bladed, single-rotor helicopter that will operate smoothly and safely in every condition of flight, ranging from zero translational speed to a quarter of the speed of sound, but at least the helicopter had emerged from the laboratory stage and, in spite of its present limitations, was already established as a vehicle of practical utility; not a competitor of other forms of transport but with unique uses of its own.

For reasons already given, the single-rotor helicopter was at present limited to relatively small sizes. If jet assistance for vertical flight became practical, the large single-rotor helicopter could operate in forward flight at reduced torque as a gyrodyne, or at zero torque as a gyroplane.

Designed for research in the transonic speed range, the Vickers model is launched from a Mosquito.

SUPERSONIC APPROACH

Exploratory Aircraft, Models and Missiles of Four Nations : Physiological Problems

LABORATORY investigation of the phenomena associated with flight at transonic speeds—i.e., at Mach Numbers between 0.85 and 1.15—has in the main proved fruitless, obliging aerodynamicists to evolve new experimental techniques. At velocities of the order stated, high-speed wind tunnels suffer from choking and constriction increasing to unity the Mach Number in the vicinity of the test model and forming a transverse shock wave. Problems presented by subsonic and supersonic speeds are comparatively easy of solution, the former by wind tunnel and flight observation and the latter by theoretical means, but in the words of Mr. E. F. Relf, Principal of the College of Aeronautics, the transonic zone remains an almost virgin field.

By H. F. King, M.B.E.

Thus it is that in Great Britain, America and France brains and funds are being concentrated on new equipment, among which piloted and pilotless aircraft, flying scale models and missiles have a leading place. The wind tunnel as a medium of research does not thereby become extinct—in fact, the U.S. Government is considering the construction of four transonic and supersonic tunnels at a cost of about £60,000,000—but for certain lines of enquiry in a given speed range it must for the present make way for new instruments of investigation.

Since last May, when Mr. Relf delivered his Wilbur Wright Memorial Lecture on "Recent Aerodynamic Developments," brief particulars of several high-speed research aircraft have been disclosed. Most of these are under construction, but two—the DH 108 and the Bell XS-1—have flown.

Neither the D.H. nor the Bell has officially exceeded the world's air speed record of 616 m.p.h., established last September with a Gloster Meteor IV flown by G/C. E. M. Donaldson, though the second 108 prototype may well have beaten this four-run average before its disastrous end. In any case, peak speeds of about 630 m.p.h. had been recorded on proving flights by Gloster pilots.

Remarkably enough, the record-holder is a slightly modified standard fighter, the basic design of which is now about five years old. Equally anomalous is the fact that

With its booster rocket in place the American Tiamat research missile, seen heading seaward from its launching ramp, is over fourteen feet long.

SUPERSONIC APO

the highest Mach number yet reached by a piloted aircraft—about 0.9—stands to the credit of a Spitfire of the Royal Aircraft Establishment, which attained it in a dive at 30,000ft.

Praise is due not only to the Spitfire—enabled to attain its high Mach value by virtue of its unusually "slim" design—but to the R.A.E. pilots detailed for diving tests on this and other high-speed types, including the Mustang and Meteor. In the compressibility zone, of course, their aircraft were often partially out of control, and full command could be regained only at comparatively low levels.

Trials of this sort have drawn attention to serious physiological problems. The successful introduction of turbine and rocket power plants, and the amazing increases in aircraft speeds within three years, have persuaded many people that safe supersonic flight is nearly accomplished and that only a few incidental difficulties remain, but there is abundant evidence to the contrary. Apart from difficulties of control, stability and strength, problems no less intractable are admitted by aero-medical authorities.

One of the most urgent requirements is a safe means of escape from an ultra-high-speed aircraft. German research indicates that the maximum direct wind blast which can be withstood by a man is reached at about 500 m.p.h., and that at greater speeds the ramming effect of the air blast may produce inflation of the lungs and parenchymal tears, distortion and laceration of facial tissues and possible fractures of extremities.

Moreover, despite German, British and American investigation into the problems of pilot-ejection, much remains to be discovered and proved as speeds and altitudes increase. Certainly an individual must have some sort of enclosure or "capsule" to protect him against the force of the airstream, low pressure and low temperature.

Acceleration and deceleration must also influence design, for although the initial acceleration forces of rocket-propelled aircraft and missiles may be within the limits of human tolerance and are now, in fact, the subject of special research, deceleration presents a more formidable problem. In this connection, Brigadier General Grow, Air Surgeon of the U.S.A.A.F., submits that a worthwhile research question would be, "What is the magnitude of deceleration when a rocket motor fails when the vehicle is travelling at a speed of, say, 1,500 m.p.h.?"

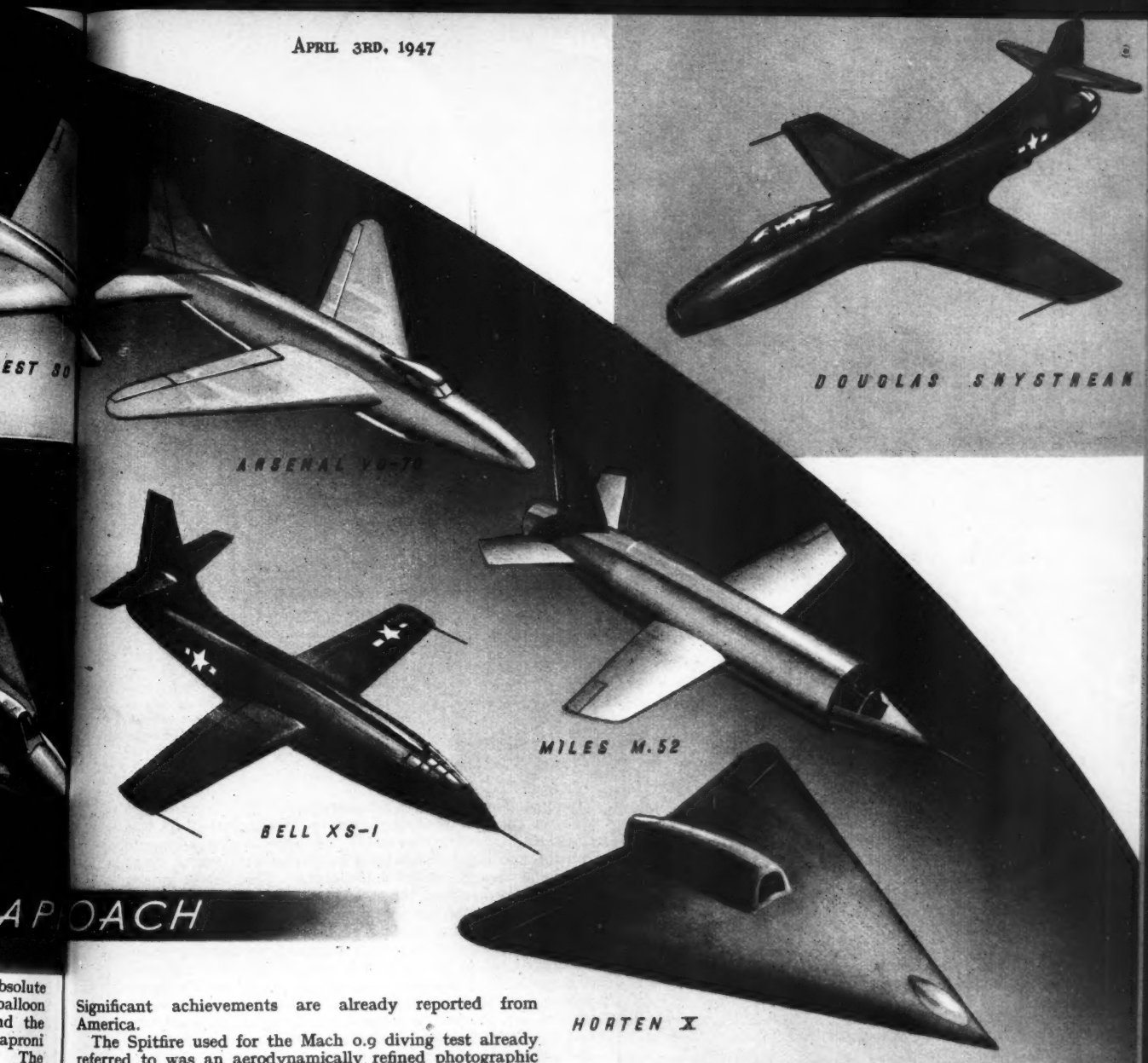
The means of bringing about acceptable deceleration must also concern designers. Air brakes—at least in any form in which they are known to-day—are impracticable, and it may be necessary to use retarding rockets. This scheme was tried on German gliders for reducing the landing run. Zooming will not always be feasible in view of the tremendous heights likely to be attained.

To a large extent high speeds will be associated with high altitudes, confronting the designers of ultra-fast aircraft with yet another set of problems. The absolute height record stands to the credit of the American balloon which, over ten years ago, attained 72,395ft, and the heavier-than-air record is held by an Italian Caproni biplane which reached 56,032ft in October, 1938. The greatest height yet claimed for a jet aircraft is 51,000ft, lately attained at Boscombe Down by a Nene-Vampire prototype. Such achievements demand of the pilot not only physical fitness but a high order of courage, for pressure cabins are far inferior to power plants and airframes in their efficiency and reliability and, in Great Britain at least, no pressure suit is yet available as a safeguard against the peril of cabin failure. While designers and engineers are evolving better pressurizing systems, medical workers must be investigating the effects on the human body of explosive decompression at various heights.

It will not suffice to protect the pilot of a future research aircraft against low temperatures and pressures, the effects of rapid acceleration and deceleration, and the fearful hammering of the airstream. At supersonic speeds he must be insulated against the heat generated by skin friction, demanding study of cockpit refrigeration, special garments and thermostatic devices.

International Technique

The approach to supersonic flight with piloted aircraft will indeed be hazardous. One of the world's finest test pilots has given his life and a precious research machine has been lost; therefore the perfection of remote-control techniques for full-scale aircraft, models and missiles, such as those now to be described, is of the most pressing urgency.



Significant achievements are already reported from America.

The Spitfire used for the Mach 0.9 diving test already referred to was an aerodynamically refined photographic reconnaissance machine; thus to the DH 108 falls the distinction of being the first British aircraft (apart from the old Schneider machines and one or two types such as the Sabre-engined Heston monoplane) constructed specifically for the study of high-speed flight.

Even the least perspicacious student of aerodynamic development could hardly fail to appreciate that the 108 was designed to exploit German research; nevertheless, it does its manufacturers credit. When Germany collapsed, the Messerschmitt fighter which it most nearly resembles (Project 1111) had not flown, whereas the de Havilland was first tested on May 15, 1946—only seven months after the drawing were commenced.

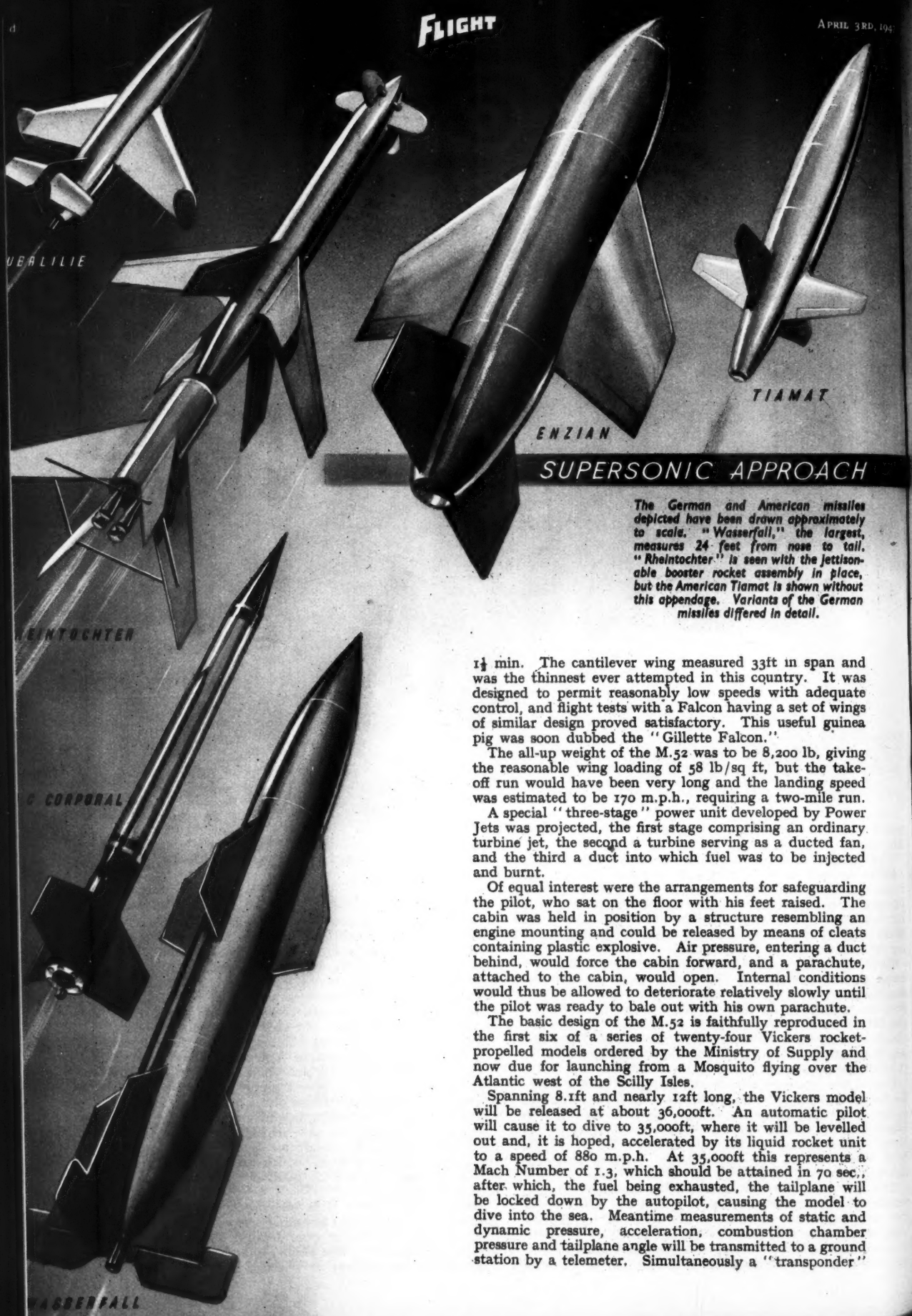
Use of the present tense in the foregoing is deliberate, for notwithstanding the tragic disaster which overcame the second prototype of the 108 while the late Geoffrey de Havilland was determining its characteristics at very high Mach numbers, development will continue. Data obtained from trials will be applied to future military and civil aircraft such as the multi-jet, 90,000 lb DH 106.

The 108 was built to establish the aerodynamic and structural characteristics of its wing and the behaviour of the dual-purpose "elevons." Though the swept-back wing is evidently desirable for flight at high Mach numbers, it introduces serious problems of control and stability. An inherent tendency towards tip stalling must be counteracted by slots (these are, in fact, fitted on the 108), or by some alternative means such as boundary-layer control, as used on the AW 52 flying wing. The increases of lift obtainable with slots and flaps are poor on a sharply swept wing, and structural flexing can react dangerously on control, but evidence that these and other besetting difficulties have to a large degree been overcome in the design of the 108 was provided last year by demonstrations of high-speed aerobatics, steep climbing turns from take-off, and by dives and level runs at high Mach values.

With the DH Goblin turbine jet initially fitted the 108 proved itself capable of speeds appreciably in excess of 600 m.p.h., and the installation of the more powerful Ghost might fairly be presumed to permit more than 650 m.p.h.

Up to the present the only British aircraft known to have been designed for *supersonic* flight is the Miles M.52 (E.24/43), construction of which has been shelved in favour of experiments with pilotless air-launched models of similar shape.

Detail design of the M.52 was nearly complete over a year ago, and component assembly was well in hand. The machine was described in some detail in *Flight* of November 12 and October 3 last year. Intended for a speed of 1,000 m.p.h. at 36,000ft, it was to attain that height in



SUPERSONIC APPROACH

The German and American missiles depicted have been drawn approximately to scale. "Wasserfall," the largest, measures 24 feet from nose to tail. "Rheintochter" is seen with the jettisonable booster rocket assembly in place, but the American Tiamat is shown without this appendage. Variants of the German missiles differed in detail.

1¼ min. The cantilever wing measured 33ft in span and was the thinnest ever attempted in this country. It was designed to permit reasonably low speeds with adequate control, and flight tests with a Falcon having a set of wings of similar design proved satisfactory. This useful guinea pig was soon dubbed the "Gillette Falcon."

The all-up weight of the M.52 was to be 8,200 lb, giving the reasonable wing loading of 58 lb/sq ft, but the take-off run would have been very long and the landing speed was estimated to be 170 m.p.h., requiring a two-mile run.

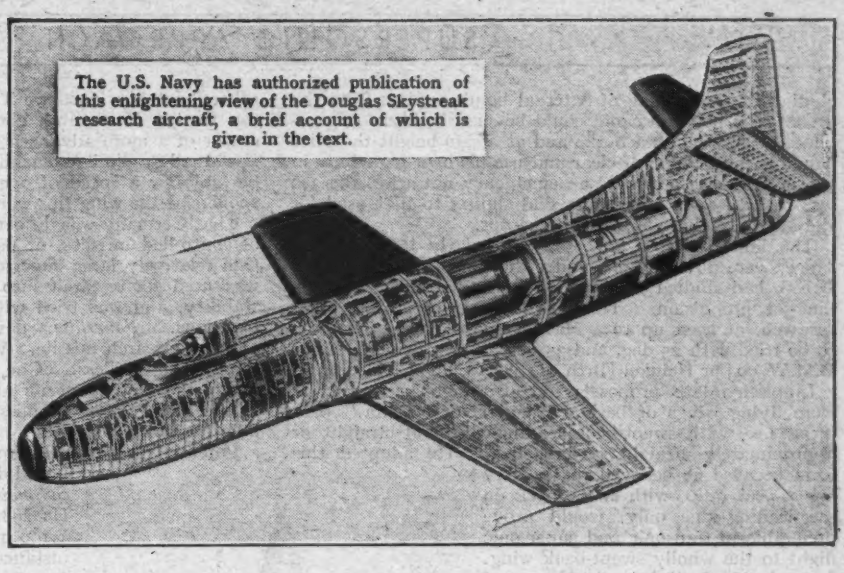
A special "three-stage" power unit developed by Power Jets was projected, the first stage comprising an ordinary turbine jet, the second a turbine serving as a ducted fan, and the third a duct into which fuel was to be injected and burnt.

Of equal interest were the arrangements for safeguarding the pilot, who sat on the floor with his feet raised. The cabin was held in position by a structure resembling an engine mounting and could be released by means of cleats containing plastic explosive. Air pressure, entering a duct behind, would force the cabin forward, and a parachute, attached to the cabin, would open. Internal conditions would thus be allowed to deteriorate relatively slowly until the pilot was ready to bale out with his own parachute.

The basic design of the M.52 is faithfully reproduced in the first six of a series of twenty-four Vickers rocket-propelled models ordered by the Ministry of Supply and now due for launching from a Mosquito flying over the Atlantic west of the Scilly Isles.

Spanning 8.1ft and nearly 12ft long, the Vickers model will be released at about 36,000ft. An automatic pilot will cause it to dive to 35,000ft, where it will be levelled out and, it is hoped, accelerated by its liquid rocket unit to a speed of 880 m.p.h. At 35,000ft this represents a Mach Number of 1.3, which should be attained in 70 sec., after which, the fuel being exhausted, the tailplane will be locked down by the autopilot, causing the model to dive into the sea. Meantime measurements of static and dynamic pressure, acceleration, combustion chamber pressure and tailplane angle will be transmitted to a ground station by a telemeter. Simultaneously a "transponder"

SUPERSONIC APPROACH



The U.S. Navy has authorized publication of this enlightening view of the Douglas Skystreak research aircraft, a brief account of which is given in the text.

unit will receive a signal from a ground station and by re-transmitting it on a different frequency, will facilitate radar tracking. The fuels used for the rocket unit, which gives a thrust of 800 lb, are the German T and C Stoff.

British aerodynamicists should profit greatly from the tests of the Vickers models. Already they have obtained data from free-falling "bombs" in the shape of model aircraft, from which instrument readings are signalled to the ground or from which test apparatus may be salved after impact. Radar tracking has also been tried.

Germany

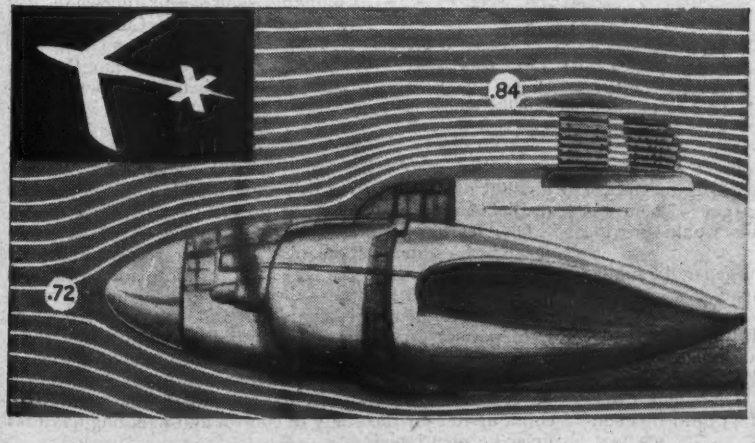
Investigation has confirmed that, as her defeat approached, Germany held a marked lead in transonic and supersonic research. This may be attributed to lavish provision of experimental equipment, possession of practical rocket power plants and—perhaps most important—the knowledge that swept-back or swept-forward surfaces could delay the onset of compressibility.

A theoretical argument to indicate the nature of the sweep-back (or sweep-forward) effect now being utilized in the design of several research aircraft and fighters has been propounded by Mr. Relf. The flow round a two-dimensional wing moved in a direction perpendicular to the leading-edge (i.e., with no sweep-back) is considered. On this motion is superposed a velocity of the wing in the direction of its span. While this has no effect on the pressure distribution, the resultant velocity is increased and is at an angle, as if the wing were swept-back.

Assuming that the two-dimensional theory would be borne out by a really two-dimensional experiment, the question remains how far the indicated gain could be realized were the aspect ratio finite, and particularly if fairly small, as is likely to be the case for aircraft with thin wings. This question, says Mr. Relf, can only be answered by experiment, but research workers are confronted with the difficulty that the wind tunnel has failed them as the desired speeds are approached, obliging them to depend more and more on flight research.

Lecturers and writers who have dealt at any length with German investigations have made particular reference to Lippisch designs for ultra-high-speed aircraft. While it is true that Lippisch investigated deeply the problems of high-speed flight, it was the D.F.S. establishment at Ainring which was responsible for the design of the 8-346 supersonic research machine to be used for measurements in the sonic and supersonic ranges. Construction was entrusted to Siebel.

The pilot of the 346 (the figure "8" merely indicated that it was an aircraft), with his test and recording equipment near at hand, was to lie prone in the pressurized jettisonable nose of the circular-section fuselage. Of fine aerodynamic form, with the maximum diameter well aft, this was largely filled by tanks for T Stoff (an 80 per cent concentration of hydrogen peroxide), and C Stoff (57 per cent methyl alcohol, 30 per cent hydrazine hydrate and 13 per cent water)—the fuels for the twin Walter rocket units mounted one above the other in the rear part. The horizontal tail surfaces were swept back, and the vertical tail assembly was of unusual profile, with the rudder entirely below the elevator.



A rig for testing aerofoils is shown installed on a Martin Baltimore. Mach Numbers at the nose and in the region of the rig are indicated. Inset is a free-falling "bomb" model.

At quarter-chord the sweep-back on the symmetrical-section wing was 45 deg. Particularly striking was the use of divided ailerons, the outboard portion of each being of very deep chord, but having no aerodynamic balance. This was to allow effective operation at high Mach numbers. Simultaneous or independent operation of the outer and inner sections was possible.

No wheels were fitted, and the 346 was to be launched from a parent aircraft at about 33,000ft. Thence it was to climb under its own power to 66,000ft, where speeds of the order of 1,200 m.p.h. were expected. An ultimate Mach value of 2.6 at 100,000ft was suggested, representing a speed of about 1,700 m.p.h.

Contrary to what might be inferred from the foregoing, considerable thought was given to the pilot's safety. Connected to the main structure by explosive bolts (the Germans employed these for many different purposes, in-

SUPERSONIC APPROACH

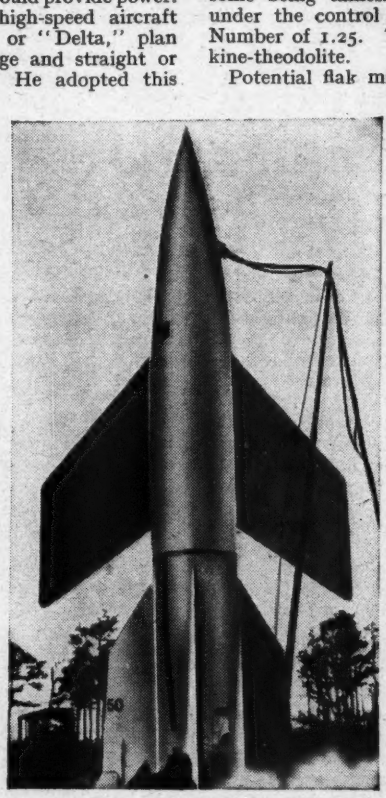
cluding the jettisoning of external bomb carriers from the Ju.88), the pressure cabin could be shed bodily. A parachute was to act as a brake and at a safe height the pilot would catapult himself clear and use his own parachute in the normal way. Should an emergency not arise, the 346 was to land on a retractable skid similar to that used for the Me 163 rocket-powered interceptor.

The limitations of the 346, particularly in respect of range, were obvious and, under the project number 1068, D.F.S. had studied a design for a larger aircraft with turbine-jet propulsion. This might have permitted fuller research, at least up to a Mach value of unity, and was to be tried with 25 deg. and 35 deg. of sweep-back. Four B.M.W. 003 or Heinkel-Hirth 011 jets would provide power.

Lippisch's late proposals for ultra-high-speed aircraft were flying wings of basic triangular, or "Delta," plan form, i.e., with swept-back leading-edge and straight or approximately straight trailing-edge. He adopted this form because he believed that a very low aspect ratio, with sweep-back on the leading-edge only, would prove preferable in transonic and supersonic flight to the wholly swept-back wing. A marked reduction in the degree of stability change at transonic speeds was claimed. Moreover, as Mr. Smelt has pointed out in his critical review of German research on high-speed airflow, a wing of this sort eases the structural problems presented by supersonic flight, whereas the swept-back wing of more normal aspect ratio severely increases the difficulties.

Lippisch further maintained that low-speed control problems would be simpler than with a tailless aircraft having a wing of more normal aspect ratio, and that below a ratio of 2½ the tip-stalling difficulty disappeared. At transonic speeds the maximum drag coefficient of a model of the Lippisch P.13 proved to be comparatively little in excess of that of many aircraft now flying at a low Mach Number.

Although the remarkable P.12 and P.13 designs had not progressed beyond the study phase, some work had been done on the P.11 flying-wing fighter, the leading edge of which was swept back at more than 45 deg. Apart from a cut-out in the centre, where the jets emerged between twin vertical surfaces, the trailing edge was straight. The P.11 was not itself intended for transonic speeds, but with two Jumo 004 turbine jets the calculated speed was 645 m.p.h.



An experimental winged version of the German A-4 ("V-2") long-range rocket. Little research was completed with this missile but stability problems are known to have been encountered.

More nearly resembling the P.13 project, the P.12 had an aspect ratio of only 1.33. It was designed for a liquid-fuel ram-jet, or athodyd, the intake for which was in the form of a projecting tube. There was a single central wheel and wing-tip skids would provide lateral steadying on the ground.

The now-famous P.13 was to have been generally similar but with an aspect ratio of 1.8. The span was less than 20ft, the wing area 215 sq ft and the weight just over 6,000 lb. This was the aircraft for which the "coal-fired" athodyd was proposed. There were various schemes for firing, one using a rotating circular basket in which combustion was initiated by a gas flame. On about three-quarters of a ton of coal an endurance of 45 min. was considered feasible.

Lippisch's conviction that the "arrow-head" wing formation was the key to supersonic flight was shared by others, notably Horten. This is evident in the design of the Horten X research glider which was to be the precursor of a more advanced aircraft with an Argus engine. Eventually a similar machine, with a HeS 011 jet, was to be built for a speed of over 700 m.p.h. Trafficator-type spoilers at the wing tips were a feature.

That Germany was desperately developing various forms of controlled missiles, or flak rockets is now well known. One relatively large supersonic missile, called *Wasserfall*, was used for research into the problems of longitudinal stability, and was tried with various wing and tail combinations. *Feuerlilie*, developed at Volkenrode, was another research missile. Various versions were designed, some being tailless. One, weighing 1,000 lb, remained under the control of its automatic pilot up to a Mach Number of 1.25. The missile was followed visually by a kine-theodolite.

Potential flak missiles from which yielded or promised useful data were *Enzian, Rheintochter, Schmetterling* (Hs 117), X-4, and Hs 298. *Rheintochter* was to attain 1,100 m.p.h. *Enzian* was, in the first instance, subsonic, but was expected to provide valuable experience at much greater speeds. The X-4 and Hs 298 were small air-to-air missiles, and the *Schmetterling* a ground-to-air weapon.

Overshadowing all was the A-4, destined to be known to posterity as the V-2. The experimental winged version, a photograph of which accompanies this article, displayed serious instability. Possibly American investigators will proceed with the research initiated by the Germans on this impressive missile.

U.S.A.

The first serious symptoms of compressibility were reported from the U.S.A., after diving tests with clean fighter aircraft—notably the P-38 Lightning and P-47 Thunderbolt—on which buffeting led to instances of structural failure. Towards the end of the war specifications were drawn up by the U.S. Army for a rocket-powered transonic research aircraft and an order placed with the Bell Company, which sent representatives to Europe to study German design technique. The outcome was the XS-1, completed a few months ago. Launched from beneath a B-29 Superfortress (the German 8-346 was to be carried "pick-a-back") the XS-1 flew its first trials as a glider but during December, 1946, after "casting-off" at 27,000 ft, a limited amount of rocket power was applied, using one of the four available units, and a speed of 550 m.p.h. attained.

One feature at present lacking on the XS-1 is a safe means of escape for the pilot, so after the machine has been handed over to the N.A.C.A. for more advanced tests sonic speed will be approached with great caution.

Except for long fairings above and below, the fuselage is of perfect form, the pilot (visibility having been ruthlessly sacrificed) being contained within the contours. For the present the wing and other surfaces have no sweep-back, but in this connection Bell's adaptation of a King-cobra fighter for the study of control and handling qualities must be mentioned.

Although a proposed development, the XS-2, is rumoured to have a swept-back wing and other refinements;

a long-term programme for the XS-1 has been declared and various wing forms may be tried. Considering its relatively modest achievements to date the XS-1 has certainly been over-publicized. As Kibitzer puts it: "They (the American daily papers) talk of shock waves and shock stalls, sonic barriers and speeds of 1,700 miles an hour and all mixed up with it are suggestions that in a year or two we shall all be flying above the speed of sound in arrow-shaped aircraft with rocket propulsion."

For the present the ultimate speed of the XS-1 could not be reached, even should the pilot, Mr. "Slick" Goodlin, be authorized to use full thrust. This is because the turbo-pump installation for feeding the alcohol and oxygen fuels into the burners has not been perfected, necessitating the adoption of a pressurized feed, using nitrogen. With this temporary system the four units of the Reaction Motors rocket can deliver only 6,000 lb thrust for 2.5 min., limiting the theoretical speed to 1,000 m.p.h. at 60,000ft, and the rate of climb to 28,000 ft/min. This power will certainly not be utilized before this summer. Eventual substitution of the turbo-pump delivery system is expected to raise the thrust endurance to 4.2 min., the rate of climb to 45,000 ft/min, and permit attainment of maximum designed speed of 1,700 m.p.h. at 80,000ft.

Structurally the XS-1 is of unusual interest because the skin of the wing, which has a maximum thickness of only 10 per cent of the chord, is machined from solid aluminium. At the root the thickness is ½in, and at the tip slightly over ¼in.

A telemeter will transmit to ground observers indications of air speed, aileron and elevator position, and acceleration. Some form of "flutter dampener" will be used to minimize the danger of changing the tailplane incidence at very high speed.

To the order of the U.S. Navy Douglas has produced, in the D-558 Skystreak, a potential transonic aircraft of equal interest. Details are displayed in the fine sectional drawing herewith. The latest Douglas figures show a gross weight of 9,750 lb which gives a wing loading at take-off of 65 lb/sq ft. Like the XS-1, the Skystreak is designed to withstand 18g. A General Electric turbine jet, with a maximum of 330 U.S. gallons of fuel, will give a much longer endurance than the rocket of the Bell.

From the standpoint of transonic investigation the Skystreak is interesting in having two systems for measuring air loads. Pressure can be automatically checked at four hundred points on the fuselage, wing and tail, and the complete load on the wing and tail is indicated by links fitted with strain gauges.

For emergency escape the fuselage nose section, with pilot, is jettisonable. When empty the wing tip tanks will be blown off by explosive charges.

Representative of American research missiles are the Douglas WAC Corporal, Boeing Gapa and N.A.C.A. Tiamat. The 16ft "Corporal" is a supersonic missile which, carrying recording instruments, has already reached a height of nearly fifty miles. Boeing's missile, rejoicing in the unofficial designation "Old Needlenose," is smaller (length 10ft), but is likewise supersonic, whereas the present type of Tiamat is no faster than the Meteor IV. Launched from zero-length rails, Tiamat has a booster rocket giving 7,200lb thrust for 3½ sec. The built-in rocket delivers 200 lb for 45 sec, sufficient time for the telemeter to transmit useful data.

The Caltec aerofoil testing rig is a 5in fin-stabilized rocket having a protruding beam for carrying the aerofoil and fitted with magnetic strain gauges.

In addition, the U.S. authorities have been firing—with remarkable results—captured German A-4 (V-2) war rockets and are engaged on the manufacture of this type of missile for further tests.

Transonic research in America is not confined to wind tunnel experiment, piloted aircraft, missiles and free-falling "bomb" models. The Martin Company, under the auspices of the U.S. Navy, has adapted an A-30 (familiar to some R.A.F. crews as the Baltimore) for testing aerofoils up to Mach 0.84. The limiting Mach Number of the Baltimore is, of course, much less—actually 0.72—but the higher figure is recorded on top of the fuselage, due to the deflection of the airflow by the nose and the windscreen. Thus, with the Baltimore diving at 540 m.p.h. the aerofoil on test is subjected to a 630 m.p.h. airstream.

France

Of French research workers, Leduc is deserving of a special tribute. His project model for a high-speed ram-jet aircraft, exhibited in Paris before the war, is now an accomplished fact, and several "pick-a-back" flights have been made, using an S.O.161 as the lower, or parent, component.

The Leduc O-10, as the research machine is known, is primarily of interest because of its novel power plant, but some valuable aerodynamic experience should be forthcoming when it casts off from its carrier.

Of more immediate interest are the two French transonic research types exhibited in the Grand Salon last November. Both are represented on pages *b* and *c*. The Arsenal VG.70-01, it will be seen, bears some resemblance in plan to the D.F.S. 8-346. Powered initially with a German Jumo 004 turbine jet, it should not exceed 560 m.p.h. in level flight, and a more powerful axial-flow unit must be installed for later trials.

Resembling the Arsenal machine in having swept-back surfaces, the S.O. M.1, its manufacturers hope, may eventually be fitted with a Rolls-Royce Derwent, though the possibility of using a Walter rocket in one version has been suggested. Initial tests will be made after an air-launch, using the aircraft as a glider.

It would be regrettable if these interesting German-inspired French projects were to be handicapped by lack of suitable power plants.

MILES APPRENTICESHIP SCHEME

AS the result of an investigation by a specially appointed committee, Miles Aircraft Ltd., of Reading, have launched an apprenticeship scheme which has not only been approved by the appropriate trade unions, but acclaimed by most as "exceptionally good." Youths are selected for the scheme by an apprentice supervisor and unless they possess exceptional qualifications, must be under the age of 16.

Throughout the apprenticeship, attendance at the Miles Technical School for two half-days a week is compulsory, and the syllabus of school-work is based on the City and Guilds examination syllabus for the appropriate trade. In addition, the requirements of the 1944 Education Act regarding further education are met.

Apprentices who do particularly well in school work, as well as their technical work, are given an opportunity of attending the Miles Technical School as full time students. At the Technical School they will have an opportunity of obtaining their Higher National Certificate in engineering or qualifying as draughtsmen or production engineers. Indentures are not issued, so that an apprentice, or the firm, can terminate the arrangement at any period if such a course is thought desirable.

FORTHCOMING EVENTS

April 7th.—Fair Oaks and Oxford Flying Clubs. Joint flying meeting, Kidlington airfield.
April 7th.—United Services Flying Club. Flying meeting Elstree airfield.
April 9th.—R.Ae.S. Southampton: An address by E. F. Relf, C.B.E., F.R.S., F.R.Ae.S.
April 10th.—G.A.P.A.N. Annual General Meeting at 5 p.m., Londonderry House, Park Lane, followed by annual dinner at 7 p.m., Connaught Rooms (York Room), Gt. Queen Street, W.C.2.
April 10th.—Royal Aeronautical Soc. "A Review of Production Difficulties in Relation to Aircraft Design." C. E. Fielding.
April 12th.—British Interplanetary Society: "Cosmic Rays," Lionel Gilbert, A.R.C.S., B.Sc., Science Museum, South Kensington.
April 15th.—R.Ae.S. Bristol. Annual General Meeting.
April 17th.—Royal Aeronautical Soc. "Testing Civil Aircraft," P. A. Hufton, M.Sc.
April 18 to 21s.—Aero Club of Spain. Madrid Air Rally.
April 24th.—Royal Aeronautical Soc.: "The Risk of Fire, and Fire Prevention Methods," Dr. J. W. Drinkwater, B.Sc., D.Phil., and W. G. Glendening.
May 3rd.—Yorkshire Aeroplane Club: Flying meeting, Sherburn-in-Elmet.
May 3rd.—British Interplanetary Soc.: "Nature and Distribution of Meteors."
May 7th.—Royal Aeronautical Soc.: Discussion on Naval Aircraft, 11 a.m.—6.30 p.m. Paper:—"Aircraft Design," W. S. Farren; "Equipment," L. Boddington; "Operational Flying," Cdr. F. M. A. Torrens-Spence; and a deck landing film by W. G. A. Perring.
May 8th.—Royal Aeronautical Soc.: "The Development of the Goblin Engine," E. S. Moult, B.Sc.
May 9th to 12th.—Royal Netherlands Aero Club. Aerial rally at Ypenburg, The Hague.
May 10th.—Air League of the British Empire (Portsmouth): Air Display at Portsmouth Airport.

American Newsletter

Timetables and Prestige : Promising Impossibilities : Red Tape at Airports : Politics and the Aircraft Industry

By "KIBITZER"

I WOULD, in all humbleness, like to make a suggestion to the international airlines. It is about their time-tables, and although I don't doubt that it is a subject which must have come up for consideration many times before, it is an idea which I believe has some psychological merit. Why must a transatlantic timetable set down not only a specific hour for departure (which is perhaps reasonable) but also a definite hour and minute of arrival? It doesn't make sense. Everyone knows that the chances of getting off from, say, LaGuardia at exactly 2.30 p.m. are slim, yet how much more remote are the chances of arriving at Paris, or Heathrow, or Amsterdam at exactly the specified minute the following day?

Once a flight is off schedule, and goodness knows there are enough hazards to throw it off, the company has lost some of its prestige in the eyes of the passengers. Surely nobody cares that much exactly what time on Friday afternoon they leave LaGuardia (obviously they must be told a specific time to report at the airline terminal with their baggage, when they can be advised of the timetable that they should follow), and equally they don't really mind not knowing the exact minute they will reach their destination on Saturday. The steamship companies don't give a docking time until after they sail, and no traveller with any experience of air transport (and I say this with both feeling and regret) will make further connections at the other end with so little time to spare that he or she must know—and be sure of—the minute of landing. (They don't come that naïve these days!)

So, instead of the present optimistic hours-and-minutes timetables, why can't we have "Airline booking office 12.30 p.m., Friday, arriving London, Saturday." That's all I would want to know anyway. And what's more, the operations staff and the pilots would have lots of variations in time available for their flight plan, without feeling all the time that some passenger with nothing better to do is going to kick up a fuss because they didn't leave at the right time, or arrive exactly on schedule. And there are some of those about, too, as any traffic man will tell you. Having thrown that one into the arena I shall be told, when I next report at the airline terminal building that the flight has been cancelled! (Later: It was.)

LIGHTENING AIRPORT PROCEDURE

THERE are definite signs over here that such august bodies as the Customs, the Public Health, and Immigration authorities are beginning to realize that Aviation is the Coming Thing. Aided by representatives of the Civil Aeronautics Board and other Federal officials, a committee is enquiring into delays and inconveniences at LaGuardia Airport. An endeavour is being made to cut through the mass of red tape that surrounds not only the arrival of the passenger but of the aircraft as well. Such things as a reduction in the paper work necessary to clear the aircraft. the possible increase in the value of goods permitted to be imported, alteration in the method of collecting the head-tax, waiving of requirements for in-transit visas, and simplification of Income Tax forms for outgoing aliens are also on the agenda.

These are quite apart from painfully obvious and long overdue increases in staff, increases which are now proposed for most of the international airline terminals throughout the country. All of these innovations will be welcome, and the idea might be extended to the airports of other countries as well. Not that any one country has a monopoly in time-wasting, in red tape, or even in rudeness. I have, in the past, been pushed around as much in England as I have here or in France, and while nobody in his right mind would dare to try and hold the proverbial candle to the Latin races once they get going in this respect, there is plenty of room for improvement everywhere.

Other, and more international, groups are also trying hard to make life less baneful for the air traveller. In Montreal P.I.C.A.O. is casting its omnipotent eye on the problem, and I.A.T.A. and the F.A.I. are both developing programmes of reform which should, in time, give some sort of result. It will be a wonderful day when one can fly from Paris, to London, to New York, to Mexico City, to Panama and down to Rio without once being in a situation that results in an undue secretion of adrenalin or bile.

FREE ENTERPRISE

MANY members of the aircraft industry here, employers and employees, are turning anxious eyes on the new 80th Congress. Controlled for the last 14 years by a Democrat majority, the pendulum has now made its inevitable swing, and the Republicans are in the political saddle. These news letters are no place in which to go into the ideological or political backgrounds of such a change, but it is essential, if we are to understand developments here, to realize the fundamental differences in outlook between the two major American political parties. Unless we do so, the changes that are made or the laws that are passed or the things that are said will be meaningless to us, and as our future, quite apart from the single field of aviation, is inexorably bound up in this country, such ignorance is not only inexcusable but dangerous.

By and large it is safe to say that the majority of the leaders of the aircraft industry over here voted the Republican ticket as did "big business" generally. In the same way the mass of the aircraft workers probably voted for the Democrats. The difference between the two parties, therefore, if translated into terms of English politics (an almost impossible and highly misleading task) would be to describe the Republicans as the Conservative Party and to consider the Democrats as representing a modified version of Labour.

But (and here is one of the paradoxical features normal to this country, and which make it so dangerous to try to forecast events) once in power there is every indication that the Republicans may favour legislation which will have, in the end, a somewhat detrimental effect on the aircraft industry. True, they will never lower the flag of "Free Enterprise and Competition," but there are signs that they may cut the U.S. Army Air Corps budget—and they are already suggesting sweeping enquiries into aviation legislature and the series of airline accidents.

A powerful political group is still fighting to have Pan American Airways recognized as the Governmental chosen instrument, a move that would penalize the other American international operators, and which would be resisted by them tooth and nail. There are other politicians who feel that the Bermuda agreement was unsatisfactory and should be reviewed. Furthermore, and perhaps more serious, there is every indication that the new Congress will not only crack down on Labour's future demands but may well endeavour to withdraw some of the benefits they have so hardly won during the last ten years. If this is done, Labour unrest will surely follow, with a falling-off of production as its inevitable aftermath.

TURTLE DATA

Additional Notes on the Design and Performance of the Long-distance Record Holder

SOME interesting details and figures regarding the *Truculent Turtle's* long-distance record were contained in a recent article in our American contemporary, *Aviation*, under the heading "In 'Operation Turtle' Design Turned the Trick." On design, the authors, Cdr. T. D. Davies, U.S.N., and Lt. Hugh L. Hanson, U.S.N.R., say that contrary to popular belief, the P2V does not have a radically new wing design. The wing root section is a modified N.A.C.A. 2400 and the tip section is a N.A.C.A. 4400 series aerofoil, both of which have excellent low-speed characteristics. Full-span flaps are, in effect, obtained through the use of aileron droop, a combination which enables the P2V to take off in little more than 300 yards at the designed gross weight of 45,000 lb, and the wide practical c.g. range is obtained through the use of a variable-incidence tailplane. The engine nacelles, which are exceptionally clean, have a down-tilt of 6.5 deg., and what is more important, give such excellent cooling characteristics that the *Turtle*, weighing 85,500 lb, was able to climb at 475 ft/min using rated power with closed cowling flaps.

It had been intended to use 600-gallon wing-tip tanks, and strangely enough at higher lift coefficients the net drag of the aircraft with tip tanks is less than that when "clean," due to the shielding effect on the wing tips, giving a reduction in the induced drag. The 600-gallon wing-tip tanks, however, made the wing structure critical for the ground condition, so 300-gallon tanks were employed instead. The smaller tanks cost less than 3 knots in cruising speed at the time they were dropped and because they provided a more favourable distribution of wing bending moment in flight, fuselage tanks were drained first.

For the record flight the take-off was made on a 6,000-ft runway, and evening was chosen as the time to take advantage of the cooler air and to minimize structural loading resulting from turbulence while flying over the Australian Continent. The *Turtle* was airborne after a run of 4,720 ft, and as an additional safety factor it was allowed to attain a speed 20 knots above that necessary for take-off. The four Jato (1,000 lb 12 sec) units were used near the end of the run to help the P2V to gain altitude rapidly.

All details of engine operation were carefully worked out prior to take-off, and with the help of torque meters, which are a standard fitment, it was possible for the pilot to operate at or near the maximum engine efficiency.

Data for the Record Flight
(September 29th to October 1st, 1946)

Modified Lockheed P2V—Neptune. Two Wright Cyclone C-18 R-3350-8 engines (2,300 h.p. for take-off).

Time	55hr 17 min
Great Circle distance	11,236 statute miles
Ground distance	11,500 statute miles
Air distance	11,665 statute miles
Average air speed	211 m.p.h.
Average consumption figure	1.41 a.m.p.g.
Average wind	4 m.p.h. ahead
Take-off weight	85,500 lb
Fuel load	8,396 gallons
Fuel percentage of a.u.w.	59 per cent
Wing loading	85.5 lb/sq ft
Take-off distance	4,720 ft

AEROTECH LECTURES

WITH the paper on "Developments in High Performance Soaring," by Mr. K. G. Wilkinson, delivered before "Aerotech" Flying Club No. 1, at Fairey Aviation Co., Ltd., Hayes, on March 13th last, the series of lectures organized by the club named is concluded for the time being.

FUEL FLOW TESTS

THE enquiry into the recent crash at Croydon emphasized the need for thorough fuel flow tests being made at all servicing airfields. It appears to have been forgotten that the Ministry of Aircraft Production gave attention to this problem some years ago, and actually a test schedule and specification were prepared. The Exactor Control Co., Ltd., was entrusted with the design and development, and prototypes were given severe tests. This fuel flow test apparatus has already been supplied to some firms, but its existence does not appear to be as widely known as it deserves to be.

NEW ALUMINIUM FACTORY

THE Aluminium Wire and Cable Company, Ltd., which was formed recently by The British Aluminium Company, Ltd., Hawker-Siddeley Aircraft Company, Ltd., and Tube Investments, Ltd., has arranged to purchase premises at Port Tennant, Swansea, from the Ministry of Supply and will enter into occupation as from the 1st May, 1947. Modifications to buildings and the installation of plant will be carried out as soon as possible, and it is expected that some production will start towards the end of the year. The company has offices, temporarily, at Salisbury House, Circus Place, London Wall, London, E.C.2.

FOR THE BOOKSHELF

Aircraft of the 1914-1918 War. By O. G. Thetford and E. J Riding. Harborough Publishing Co., 31s 6d.

ANOTHER first-rate product from the industrious Thetford/Riding partnership. *En suite* with the series *Aircraft of the Fighting Forces*, and displaying the same standard of production, this volume proves that machines of the first German war were not exclusively box-kites and rattletraps. Many of them were hardly exceeded in cleanness of design for many years after the Armistice.

The German Air Force. By W/C. Asher Lee. Duckworth. 21s net.

GENERAL Carl Spaatz, in a foreword to this book, expresses the hope that it will be studied in time not only by "the military," but by civilians of all countries. As a standard work, however, it does not suffice and seems to be more in the nature of a résumé of wartime operational intelligence, dependable and otherwise, than a fully documented study utilizing post-war evidence. Had it appeared earlier, as an interim offering, it would have met a real need, but coming as it does over a year and a half after the war it must be considered unsubstantial and ill-digested.

Although he was in a strong position during the war to write authoritatively concerning the organization and order of battle of the G.A.F., W/C. Asher Lee fares badly in dealing with technical equipment. "I have tried not to be too technical," he declares, "because I believe that technicalities are repellent except to the technician." He would have been wise to adhere more strictly to this precept; as it is, he discourses at some length on aircraft development and errs consistently in all pertinent passages.

Apart from factual inaccuracies a deficient technical background is betrayed when, for instance, the author writes of the "reliability in dive" of the Me 109. It is difficult to determine what this expression is intended to convey, particularly as the word "sturdiness" is used in the same context. Could it be linked with the reference to the Ju87 which is credited with having "diving breaks"?

Tail End Charlie. By Denis Clark. Lutterworth Press. 6s. net.

THE old thrilling stories of pirates and Indians which continue to please boys of all ages, will contrast well with the new and vivid novels of action in the last war which are now beginning to appear. *Tail End Charlie* is an exciting and gripping example of the air adventure story as experienced by a rear gunner of a heavy bomber.

If situations seem a spot more desperate than most air gunners remember them, they will help to create something of an atmosphere which must be experienced to be truly understood and which can never be completely conveyed by words alone. Readers will not be so concerned with accuracy as to worry about "bursts from Lugers," the recognition of a red undercarriage at night on an attacking Ju 88, or the well-merited, if somewhat informally worded, congratulation from the King, "Well done, Tail End Charlie!"

* * *

COPIES of the Twelfth Herbert Akroyd Stuart Lecture, delivered by Air Commodore F. R. Banks, C.B., O.B.E., R.A.F.V.R., on October 25th, 1946, may now be obtained from the University College, Nottingham, price 1s 6d. The subject was *Power Units for Future Aircraft*.

CIVIL AVIATION NEWS

Freight Airport Idle : Greek Airline Agreement : Navigation Examinations

TRINIDAD AIRPORT: The temporary waiting room and control tower at Piarco, with two British West Indian Airways' aircraft on the tarmac. Permanent buildings are to be erected on the north side of the airport, which will be two miles nearer Port-of-Spain.

AMERICAN AIRCRAFT, BRITISH ENGINES

LORD BALFOUR asked the Government last week if the purchase of further American airliners was being considered for use in our Corporations. Lord Nathan stated that a proposal had recently been received after discussions between Bristols and Lockheeds for the development of a Constellation type powered by Bristol Centaurus engines. The merits of the project, he said, and the commitments which would be involved were now under examination by the Corporations, the M.C.A. and the Ministry of Supply. Lord Balfour had indicated that he expected such an answer and had expressed his regret that further foreign aircraft might be purchased, although he naturally welcomed the reinforcing of the fleet of aircraft in British airlines. He urged that the Minister should look again at the reasons why there was so much delay in the production of British aircraft.

The engines installed in Constellations now flying are Wright Cyclones of 2,500 b.h.p., and although the Bristol Centaurus most likely to be used—the Mk. 630—has a take-off rating only about 100 h.p. in excess of the Cyclone, it has much to offer in terms of power at altitude, cruising power consumption and economical cruising speed. Experience has shown that there is unlikely to be any major difficulty in the installation of British engines in American aircraft, as, for example, the development of the DC-4M, the Skymaster with Merlin engines in Canada, which has been highly successful.

THE HEN OR THE EGG?

STANSTED airfield was opened on December 14th by London Aero and Motor Services mainly for the operation of freight-carrying aircraft, but since that time activity has been confined to L.A.M.S. for maintenance of their aircraft. This situation is entirely due to there having been no Customs facilities provided for the station. The Ministry of Civil Aviation have stated that until Customs can be justified officers will not be stationed there. On the other hand, L.A.M.S. cannot allow aircraft to land from overseas until Customs are provided. The result is a complete deadlock. L.A.M.S. themselves have an average of four aircraft movements a day, and even these they must send to Heathrow for clearance and pay the necessary landing fee. Requests have been received from operators in this country and on the Continent for operating a total of about fifty-five aircraft.

The opening of Stansted with full facilities would relieve the congestion at Heathrow occasioned by the inadequate accommodation and allow perishable goods to reach the markets without delay Stansted can provide covered loading accommodation and Customs checking sheds, and, moreover, freight would not be given second place to scheduled passenger services as at London Airport It has been estimated that about three Customs officers could manage the initial flow of aircraft, and Dr. Humby, of L.A.M.S., has even offered to pay their salaries and provide living accommodation as an inducement. Night flying, homing and ground transport facilities are already installed, and it is interesting to note that B.E.A. were considering it as a regular terminal for freight aircraft when the formation of a cargo division was contemplated.

W/C. Hulbert was to ask yesterday in the House of Commons when full Customs facilities were to be provided at this airport and what temporary arrangements now existed.

FLYING CLUBS' FUTURE

THE United Flying Club's Ball at the Dorchester Hotel on March 21st was a great success, and Lady Daphne Straight and the committee are to be congratulated on providing such an enjoyable evening. Clubs in all parts of the country were represented by organizers and members, making it very apparent that if the success of flying clubs depended entirely upon enthusiasm, their future would be assured.

Mr. Lindgren, the Parliamentary Secretary, spoke during the interval, and expressed the Government's view that private flying could be of no use to civil aviation until it was made available to the masses. It was no good purely as a sport for the rich, he said. He had to admit, however, that the Government were at a loss to know how to tackle the problem, for it was quite obvious that flying clubs could not fulfil such a function without heavy subsidy. The future of flying clubs is most certainly in jeopardy, for it will be difficult to obtain sufficient subsidy from the Government. At the moment, especially after such inclement weather, none of the flying clubs can possibly be operating economically. There would certainly be a doubtful reception in the country to further taxation for the benefit of the few who wish to fly privately.

GREEK NATIONAL AIRLINE

SINCE the end of the war the Greek airline company, T.A.E., have been operating in a limited sphere with the assistance, in the form of technical advice and financial support, of Trans-World Airlines. The Greek government are naturally anxious to resume full development of Greek civil aviation and to establish a national organization which will be commercially and technically sound. Negotiations, consequently, started some months ago between the National Bank of Greece, British European Airways and Trans-World Airlines, to form a national airline corporation, for the operation of internal and external air routes, and an agreement was signed in London on March 19th between the British and American companies. Further negotiations are now proceeding in Athens.

It is intended to form the Greek corporation with an initial capital of 2,000,000,000 drs. (approximately £100,000), in which British and American interests together shall be in a minority, but equally divided. The activities of the corporation will not be confined to scheduled operations, but will include charter services for the carriage of passengers, mail and freight, internally and between Greece and foreign countries. Naturally the operational programme and the stages by which development will take place will be governed by traffic possibilities and the supply of aircraft. In order to hasten this development, however, the American and English companies are lending skilled and experienced personnel to the corporation. Routes will first of all be opened between Athens and the principal centres such as Salonika, Crete and Rhodes, and at the same time to Greek centres of population such as Jannina, Larissa and Kavalla. The type of aircraft to be used will

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depend largely upon availability, but it is probably fair to expect that some American and British aircraft will be put into service quite soon. A technical committee will decide on the choice of the most suitable aircraft and equipment, and it will be made irrespective of the country of origin and having regard only to the requirements of the new corporation. Neither the name of the corporation nor the British representative on the board have yet been announced.

LORD KNOLLYS' RESIGNATION

VISCOUNT KNOLLYS informed Lord Nathan last week that he would be unable to continue as chairman of B.O.A.C. after June 30th. Lord Nathan has regretfully accepted the situation and in due course will make a statement concerning the chairmanship of the Corporation.

Lord Knollys intends to resume his business connection with the Employers' Liability Insurance Corporation, of which he was managing director until the beginning of the war, when he became Deputy Regional Commissioner for the South Eastern Region for Civil Defence. In 1941 he was made Governor and Commander-in-Chief of Bermuda, and it was to take over the chairmanship, in July, 1943, that he relinquished that appointment. It is understood that a term of four years was made a condition of his acceptance. As chairman he has flown 163,000 miles on air routes in all parts of the world, and has inspected personally every aspect of the Corporation's activities. He recently flew on the B.O.A.C. survey flight to Hong Kong, Shanghai and Tokyo. The period during which Lord Knollys has held office in the Corporation has probably been the most difficult in British civil aviation, and the largest British airline has been fortunate in having him as chairman. He has very often expressed his great interest in civil aviation, and it is to be hoped that he will not now be entirely lost to the industry.

"Flight" photograph.

POLAR BEAR : (Left to right) Robert Harvey, General Manager, Short and Harlands ; Col. J. K. Christie, Vice-President of Operations, D.N.L. ; H. L. Piper, Chief Test Pilot, and W. H. Hambrook, Project Engineer, of Short and Harlands, on the scaffolding of one of the Sandringham VIs now being built for D.N.L. "Kvitbjørn" is Norwegian for polar, or white, bear.

THIRTY YEARS' ROUTE FLYING

HAVING flown on what might almost be described as his own personal airline in B.O.A.C. since September last year, Capt. Dudley Travers flew the *Golden Hind* from Cairo and landed at Poole on March 24th for the last time as a regular Captain. At the end of the 1914-18 war, during which he won a D.F.C., he flew on air taxi work until joining Imperial Airways in 1926, and captained in that year the first commercial air liner to land in Egypt, the Imperial Airways D.H. Hercules. From Heliopolis he operated the first of the services between Cairo, Baghdad and Basra, and it was he who commanded the Handley Page Heracles class aircraft *Helena* on the first Mediterranean air cruise. In the last war he flew B.O.A.C. flying-boats on routes from the U.K. to West Africa and India.

Capt. Dudley Travers, D.F.C.

During thirty years' flying Capt. Travers has completed 19,000 hours in the air, without accident.

NAVIGATION LICENCES

SOME concessions have been made by the Licensing Department of the Ministry of Civil Aviation to enable the older pilots with experience but without navigation qualifications to take a modified examination, and so qualify for the 2nd class and 1st class navigators' licences. There has been some concern amongst the charter companies that many of their pilots would not be permitted to fly passengers when the P.I.C.A.O. licensing standards were established, and yet, many of them, although not qualified on paper, have a great deal of experience of flying by their own navigation methods.

The special conditions are as follows for 2nd class certificate: Any pilot who on June 1st, 1946, had 7,000 hours or more flying time as pilot/navigator and who was more than 40 years of age on that date will be permitted to take a modified examination, which will be similar to that conducted for the "restricted 2nd class licence" during the war. It will be mainly an oral examination on the syllabus, but including a short and very straightforward plotting paper. This proposal will help to overcome the difficulty which older pilots seem to experience in expressing themselves on paper and producing a given amount of work within a strict time limit. For the 1st class navigator's licence the general experience and age qualifications are as for the 2nd class certificate, with a further requirement that the 7,000 hours shall include 2,200 hours in command on long-distance airline routes normally requiring the holder of a 1st class licence to be carried on board the aircraft. These qualifications are in lieu of the 5,000 hours mentioned in C.A.P. 44, 14th Edition (Revised), Appendix VI, paragraph 3. Other conditions of paragraphs 3 and 4 of the pamphlet remain unchanged, with the exception of the examination in tides, which is no longer required.

The Guild of Air Pilots and Air Navigators consider that 7,000 hours for the 2nd class licence is too high, especially in view of the identical qualification for the 1st class licence. The Guild have, therefore, suggested that 4,000 hours would be a more just qualification and have notified the Ministry.

Notice to Airmen, No. 67, issued last week, was concerned with the introduction of aircraft navigators' licences to P.I.C.A.O. standards. New licences will be granted to holders of current 1st class licences based on the full syllabus, without further examinaton. Holders of 1st class licences based on the modified wartime syllabus will be required to take a full examination in Form of the Earth and Aeronautical Charts, in addition to complying with the requirements of C.A. Pamphlet 44, Appendix VI. Validity of licences will be extended until the introduction of the new standards. Applicants holding a 2nd class licence will be required to take the full examination.

U.S. CHARTER FLYING REGULATIONS

THE American Civil Aeronautics Board has made certain amendments to the Civil Air Regulations covering non-scheduled operations. A review of recent aircraft accidents indicated the need for additional operating restrictions for non-scheduled airlines, and draft amendments were circulated in October last year for comment.

The amendments represent a tightening up on aircraft maintenance, flight time limitations for pilots, the serviceability of equipment, weather minima, instrument approach and land-

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ing rules, and the required airborne instruments and equipment. The operating regulations for non-scheduled airlines will, consequently, be similar to those imposed upon the scheduled companies, particularly in the case of those operating multi-engined types of aircraft.

BREVITIES

Sir Patrick Dollan, chairman of the Scottish Advisory Council, and Sir William Thompson, chairman and managing director of Scottish Motor Traction, Ltd., have been appointed members of the Scottish Divisional Aerodromes Board. A. Cdre. J. G. Murray has already been appointed chairman.

* * *

Air France plans an expansion of overseas services during the coming summer. Flights between London, Paris and Nice are to be doubled in July, and the Paris-Rome Service will be increased to three flights weekly. New services will be started to Shanghai and Indo-China later in the summer, and schedules to Cairo will be increased to twice a week. A daily service between Marseilles, Corsica and Nice is also to be started.

* * *

Figures from America show that the Constellation has now flown a total of 73,000 hr with ten different operators. During four years of military and civil operation the type has flown more than 675 million passenger-miles without passenger fatality. The only deaths were in a training flight accident.

* * *

The Minister of Civil Aviation has appointed two new members to the Air Safety Board, Dr. Leonard Bairstow, C.B.E., F.R.S., a consultant in aerodynamics, and Sir William Halcrow, M.Inst.C.E., a consulting engineer.

* * *

Although the route mileage covered by Air India during 1946 was the same as in the previous year, the company carried nearly three times as many passengers and flew nearly a million miles more.

* * *

Pan American Airways have started a weekly service from London to Boston and Washington. Aircraft will leave London every Friday at 1800 hr., arriving in America the following day. This new service is in addition to the daily flights between London and New York.

* * *

British European Airways' Scottish Division are now providing five daily services in each direction between Scotland and Northern Ireland. An evening flight from Renfrew to Nutts Corner has been introduced, and the existing late service from Nutts Corner to Prestwick will continue.

* * *

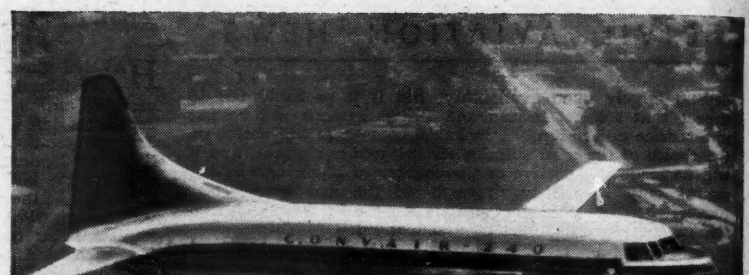
Trans-Canada Air Lines have planned a complete V.H.F. network across Canada to enable aircraft to be continuously in touch with control stations. They will be about a hundred miles apart, so avoiding skip effect and fading reception in bad weather.

* * *

Capt. O. P. Jones has resigned from B.O.A.C. to take up the appointment of chief pilot to Aer Lint, the Irish trans-Atlantic airline company. He joined Imperial Airways when it was formed in 1924 and was made an O.B.E. in 1945 for outstanding services in the air.

* * *

The Guild of Air Pilots and Air Navigators has placed on record its appreciation of the help given by S/L. R. C. Preston to the Employment Advice Bureau which was set up to help members in finding situations in civil aviation. The Bureau is doing excellent work and there have been many enquiries during the last few months. S/L. Preston has now resigned, and until such time as someone can be appointed permanently Major Jim Cordes, the well-known test pilot who was for many years with Handley Page's, has taken over the Bureau.



INITIAL FLIGHT : The Consolidated Vultee twin-engined Convair 240 flew for the first time last month. This forty-passenger transport has a pressurized cabin, and augmented exhaust thrust assistance. Only estimated performance figures are so far available.

FROM THE CLUBS

Luton Flying Club have a full programme for Easter and the rest of April. There is to be a spot-landing contest at 3 o'clock on Easter Sunday, and a navigation race on April 13th. Informal dances are to be held on the 5th and 19th, and a general meeting on the 20th. On the 27th, between 3.30 and 4 p.m., the club have organized a tea patrol. Incidentally, the official opening of Portsmouth Aero Club is due to take place on the 26th at 5.30 p.m.

* * *

West Suffolk Aero Club have made good use of their one Auster since the end of the long period of bad weather. A social evening was held at Black Tiles, Martlesham, on March 12th, when club wings were presented with due ceremony to six members who had recently obtained "A" licences. Mr. Courtney Prentice, the club's chairman, gave an interesting account of activities. Work on the clubhouse has been started by members, and it is hoped to have it habitable soon.

* * *

The committee of the Royal Aero Club have decided that present conditions do not warrant the organization by the club of any major air racing events during 1947. They have agreed, however, to give full support to events organized by individual clubs affiliated to the Association of British Aero Clubs.

* * *

The London Gliding Club is now able to accept new flying members for the year 1947-8. During the war the club was kept alive by the interest of a few old members, and although the clubhouse on Dunstable Downs was requisitioned, a temporary clubhouse was lent by Mr. and Mrs. Turvey, of Tottenhoe, who have been faithful friends to the club since its earliest days.

In January, 1946, the club owned one Tutor sailplane, all the others having been taken over by the Government. Gradually the club has obtained more machines, however, and is now almost back to pre-war standards, with nine machines—two Cadets, four Tutors, a Gull sailplane, a side-by-side two-seater, and an SG.38 Primary. There are two winches and three retrieving cars. Mr. R. C. Reid is now a full-time instructor. Owing to the increasing cost of materials and labour, and the difficulty and expense of obtaining new machines, the membership and entrance fees have had to be considerably increased. The entrance fee is now £5 5s, flying membership £6 6s p.a., and associate membership £2 2s. These charges may seem expensive, but actual flying charges are very small. On the training machines hops are 1s 6d each, not exceeding 6s a day however many are made; full launches plus five minutes' flight are 2s 6d each, and 6d for each ensuing five minutes; the Gull charges are 15s an hour.

Most of the flying is done at week-ends, but mid-week flying can be arranged with Mr. Reid. The club is running instructional courses at Easter, Whitsun and in August during 1947, and particulars of these can be obtained from the secretary, Mrs. Cooper, White Lodge, Berkhamstead, Herts, who can also supply entry forms for full membership.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

AIRCRAFT PORTRAYAL

The Spirit of the Subject

FIRST may I express my deepest sympathy and regrets that *Flight* was faced with the greatest tragedy that can befall a journal—to miss an issue, after appearing regularly throughout the blitzes and shortages of a major war?

I should also like to express my appreciation of a little-publicized feature—namely, the high standard of present-day coloured advertisements, the quality of which was unknown before the war. Among the selection of good artists' work which frequently adorns the front cover of *Flight*, I think that of Frank Wooton's is the greatest. His effective brush strokes seem to portray the whole character of any aircraft better than any other artist. It is a curious fact, too, that if one desires to paint aircraft the average conventional artist looks down his nose and says, "Oh, aeroplanes." Actually I have never yet seen a painting of aircraft by a conventional artist (as opposed to an air specialist) which achieved the spirit of the subject.

As a lover of aircraft, and an amateur dabbler in the painting of aircraft, I should be very interested to see a short series of articles in *Flight* on Britain's Aircraft Artists as a sequel to the absorbing Britain's Test Pilots series. Perhaps other appreciative readers would support my request.

Finally, may I add that a visit to the Imperial War Museum is worth anyone's while, simply to see Wooton's magnificent painting "Typhoons at the Falaise Gap."

"WOOTON STRUCK."

P.R.U. BADGE

R.C.A.F. Photographers

I WAS interested to see the letter signed "Benson, 1942," in *Flight*, March 13th, on the subject of the P.R.U, badge, and I am enclosing herewith a flash which was adopted by the R.C.A.F. for photographers.

The flash shows an F.24 Camera in its hand held form complete with trigger release and sight.

J. E. ODLE.

Williamson Manufacturing Co., Ltd.

NORTHOLT OVERSTAFFED ?

Two Employers and Two Rates of Pay

A FEW weeks ago I wrote to my M.P. stating the conditions under which Runway Controllers are employed by the Ministry of Civil Aviation at Northolt, pointing out that the rates of pay are £5 per 48 hour, seven-day week, which compares very unfavourably, *pro rata*, with the local rate of £5 14s for unskilled labourers.

This matter was raised in Parliament, and, although I do not wish to labour the point, I do feel that this situation is only one aspect of a general tendency which is truly alarming.

The staff at Northolt are employed either by B.E.A. or M.C.A., and employees of the former are substantially better paid than those of the latter. It can be shown that two men doing similar work, but working for B.E.A. and M.C.A. respectively, receive very different rates of pay; yet, in each case, the Treasury is ultimately responsible.

The ridiculous, but nevertheless authoritative, reason for this is that while the M.C.A. are working on pre-war standards, B.E.A., likewise B.O.A.C. and B.S.A.A., have no such standards.

A remote body known as the Establishment Board is responsible for M.C.A. rates of pay, and their dogged determination not to advance beyond 1939 in this matter is only paralleled by their indifference to the present manpower situation.

The staff of Northolt's Air Traffic Control Section is, by common consent, out of all proportion to requirements, and for every two persons employed there, one is quite superfluous.

It is common knowledge that the M.C.A. never say, in effect, "Now, here is a job to be done, let us employ a man to do it." Quite the reverse: "Now, let us see what we can find for you to do . . ."

If I thought that this alarming situation was confined to Northolt's Air Traffic Control Section, I should be quite happy to persist in my attempt to get it rectified locally.

I can only give the facts of which I am sure, but as I see so many girls knitting, so many men reading their newspaper, as I see a fleet of new empty buses ploughing round the airport for the benefit of the employees, their schedules depending largely on the whim of the drivers, I have every reason to suppose that this wastage is a general tendency.

What the M.C.A. do at Northolt they may, heaven forbid, do elsewhere.

It is this which I find really alarming, and it is in what I believe to be a public spirit that I write.

PETER J. CROFTS.

CROYDON DAKOTA CRASH

An Opinion on the Possible Cause

THE cause of this accident is, I consider, very clear; but before expressing my opinion the following facts are submitted for consideration.

During the public enquiry a witness stated that an examination of the port engine carburettor showed that the setting was in the auto-lean position. Examination of notes on the Stromberg carburettor shows that the auto-lean mixture ratio is about 15 to 1; the auto-rich ratio is about 12 to 1. The mixture rate per lb air to per lb fuel is 0.07 for auto-lean, and 0.11 for auto-rich. These differences are mathematically very small, but they result in a loss of no less than some 200 h.p.!!!

If during the time of take-off an air leak develops, assuming that an air leak existed in the port fuel system, and the evidence is such that there is every reason to suspect its existence, the effect would be similar to running the engine on auto-lean; and the effect would develop progressively. During the take-off run it is probable that the defect would remain unnoticed, the boost pressure would remain unchanged, but the loss of power would become manifest immediately the aircraft became airborne. A lightly laden aircraft might get away without any serious consequences, but with a full load the loss of some 200 h.p. would be critical.

This theory can be tested by taking an aircraft off run with one engine in auto-lean and the other in auto-rich. If unladen it might become airborne, the pilot, being prepared, could take quick action if necessary; but if the aircraft was fully loaded to 28,000 lb I would expect a repetition of the Croydon incident.

S. JAILLER.

"Listen to this—For sale, shopsoiled motor-cycling suits Ideal for R.A.F. personnel."

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

PARADE IN THE SUN: The Vickers Vikings of the King's Flight make a proud sight as they await the Royal Family at Bloemfontein.

Battle of Britain Memorial

HIS MAJESTY THE KING has graciously consented to unveil the Battle of Britain Chapel in Westminster Abbey at noon on Thursday, July 10th, 1947. The next of kin of aircrew of R.A.F. Commands and the Fleet Air Arm who are known to have lost their lives in the battle (between July 10th and October 31st, 1940) are invited to submit written applications without delay for tickets to enable them to attend the ceremony.

When submitting applications next of kin are requested to state their relationship and the number, rank, full names and squadron of the aircrew in respect of whom application is made. As the space is limited, the number of tickets it will be possible to issue to any applicant will depend on the number of applications received. All applications and enquiries should be addressed to Air Ministry (S.4 (f)), King Charles Street, Whitehall, S.W.1.

Bruneval Ceremony

THE historic raid on the Bruneval radar installation will be commemorated by a monument, the first stone of which is to be laid near the site by General de Gaulle next Sunday. Aircraft of the R.A.F. may fly past, and there will be a strong military representation, including men who took part in the raid.

It may be recalled that after the installation had been located by a P.R.U. aircraft in 1941 S/L. "Tony" Hill, considered the greatest low-oblique photographer of the war, made a close reconnaissance and reported on the appearance of the installation, but his camera failed.

Next day, when about to take off again, he was stopped because three aircraft from another squadron were scheduled to be near Bruneval at the same time. Thereupon, it is said, he taxied across and told them that if he found them within 20 miles of the target he would shoot them down. He got his pictures unmolested and they were among the classics of the war.

The French Resistance Movement, who are subscribing to the cost of the memorial, which is near the site of the raided radar station, provided a plan of the German defences. The success of the landing finally depended on F/S. C. W. H. Cox, who had never before left England, by sea or air. Warned at his final briefing of the danger of interrogation if captured, and above all against any German who might be kind to him, he smiled and said: "I can stand a lot of kindness, sir." Parachuting with the Army Commandos from one of the R.A.F. carrying aircraft, which were led by the late G/C. P. C. Pickard, his coolness under fire in dismantling the German radar set, which bore bullet scars when he brought it back helped largely towards the success of the raid.

Exit the Fore-and-Aft?

A BERET may be adopted for all ranks of the R.A.F. and W.A.A.F., replacing the forage cap for men. The badge will be clipped to the front, above the right eye.

U.S. of S. Defends Aircraft

WITH a very cheerful gathering at the Connaught Rooms, on March 24th, the University of London Air Squadron held their first post-war dinner. Introducing the guest of honour, Mr. Geoffrey de Freitas, M.P., U.S. of S. for Air, W/C. D. W. Reid, D.F.C., the Chief Instructor, gave a review of the squadron's history from its formation in 1935, through the vicissitudes of war up to the present basing at Biggin Hill with a strength of three Tiger Moths and an expectation of eight. The present establishment of the squadron is 100, but for the current year a strength of 75 per cent obtains, although there is no lack of applications for membership. Ex-R.A.F. members are on the strength for the first time, completing training, and the squadron is again effectively a V.R. training establishment.

Mr. Geoffrey de Freitas, said in his speech:

"I have heard it said that the aeroplane to-day is as obsolete as the battleship and that the age of pilotless aircraft and guided missiles is upon us. I can assure you that the aeroplane will be with us for many, many years. This is not devotion to an instrument which served us so well in the last war, and it is not reliance on the weapons of the last war to fight the next war. It is merely a statement based on the stage of technical development which we have reached. Furthermore, I can assure you that the air marshals and generals of to-day are not like the cavalry officers of not so long ago who refused to experiment with tanks because they did not whinny or eat hay."

Among the guests were A. V-M. Sir Allan Lees, C. in C. Reserve Command, A. V-M. F. H. M. Maynard, A. Cdre. E. P. H. Davies, A.O.C. 65 (L.R.) Group, and A. Cdre. D. MacFadyen.

Badge of No. 123 (East India) Squadron, R.A.F.—"Swift to Strike."

Badge of Central Gunnery School, R.A.F.—"I hold my aim."

Borneo Courier

THE following account by F/O. R. P. Connor illustrates the value of the work of a non-military nature now undertaken by the R.A.F.

Regularly once a week, he writes, sharp at 8 a.m. every Thursday, a Sunderland of No. 209 Squadron takes off from R.A.F. Base, Seletar, with a load of passengers, freight and mail, bound for a round trip of Borneo. En route, the aircraft calls in at Kuching, Labuan and Jesselton, and if the necessity arises it will stop at remote places such as Brunei, Sandakan, Sibu and Kudat.

This service is a very popular one with the European inhabitants of Borneo, as

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it means that they get their mail and provisions with unfailing regularity once a week. The crews bring tit-bits of information on current affairs that have not reached Borneo previously and a week's supply of newspapers which under normal circumstances arrive by sea and are months out of date.

Another thoughtful little service carried out by the crews is the purchase in Singapore of small household necessities and other little commodities that are unobtainable in Borneo, and which help to make life a little more pleasant. Often the civilians find it quite difficult to persuade the crews to accept the money for which the goods were purchased, the argument they come up against generally being: "Well, take them as a little gift in return for the hospitality shown to us by you whenever we night-stop with you."

The squadron commander, W/C. L. M. Laws, and flight commander S/L. A. M. Ruston, D.F.C., have on many occasions piloted His Excellency the Governor-General, Mr. Malcolm MacDonald, and other V.I.P.s around Borneo, when they have been complimented on the efficient and speedy manner in which journeys were handled.

Training Indian Crews

THE first squadron of the Royal Indian Air Force—No. 12, composed entirely of Indians—is to undergo a conversion course from single-engined fighters to Dakotas. The squadron was formed at Kohat, North West Frontier Province, in 1945, and is the youngest squadron of the R.I.A.F. Training, by R.A.F. instructors, is now under way at Mauripur.

When wells dried up, crews of No. 12 Squadron flew water from Karachi to Poona and Jiwani, on the Arabian Sea coast.

York Accident

THE Air Ministry regrets to announce that when a York aircraft of R.A.F. Transport Command crashed shortly after take-off on a flight from Negombo, Ceylon, on March 18th, 1947, the following fatal casualties occurred:—

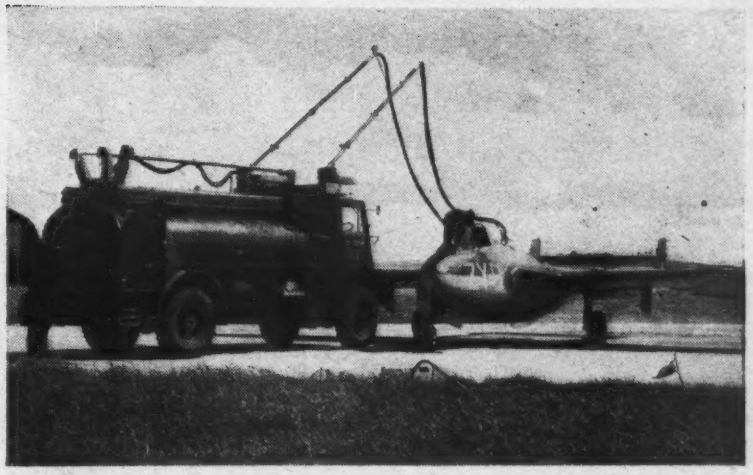
Passengers

Mr. G. H. Cheyne, Capt. G. V. Price, Mr. J. C. Glass, Mr. A. Deighton, Mr. C. H. Yep (Chinese), Mr. H. N. Lee (Chinese), F/O. A. N. Brumwell, R.A.F.

Crew

F/L. S.A. Anning, D.F.C., R.A.F., W/O. W. Taylor, R.A.F., W/O. J. W. Tait, R.A.F., F/S. C. Grant, R.A.F.

The next of kin have been informed. Four other occupants of the aircraft were slightly injured.



NOT 100 OCTANE: Filling two Vampire tanks simultaneously from a standard R.A.F. refuelling unit. The advent of jet propulsion has added yet another type of fuel to be stored.

"P.R." and Jets

IN addition to various marks of Mosquito, the Hornet and a number of adapted single-seat fighters, R.A.F. Station Benson has been experimenting with jet aircraft for photographic reconnaissance work. Benson was the base of most of the P.R.U. squadrons during the war and is now engaged in the development of air photography and the training of crews. A tactical wing is carrying out an intensive flying programme in this country and overseas for various Government departments. An air survey of the British Isles is being flown and from these photographs the Ordnance Survey Department are completely revising existing maps. Two-thirds of the country has already been surveyed in this way and one result has been a considerable speed-up in the work of the Ministry of Town and Country Planning. Projected roads and new areas required for afforestation are also surveyed from the air.

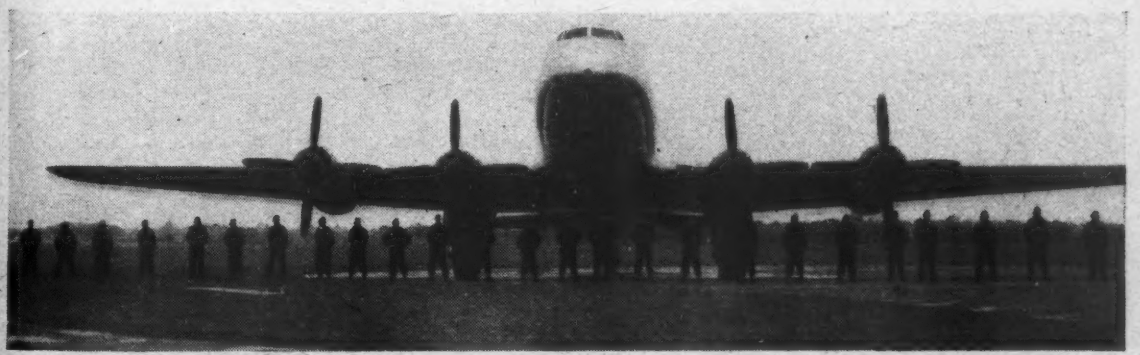
Among the tasks accomplished are surveys for a motorway from Birmingham to Bristol, hydro-electric scheme on the Volta river in the Southern Gold Coast, and the mapping of West Africa, the Middle East and India. In the past year alone 380,000 square miles have been photographed.

Many of the tasks flown by Benson aircraft are occasioned by current events. The recent wet weather, with consequent flooding caused by the overflow of the Thames and the Trent, called for air photography to show the extent of the floods and afterwards to reveal where water was failing to drain off as the floods subsided.

The R.A.F., it must be pointed out, is not encroaching upon the work of civil air photography firms but is concerned only in training and in the development of air reconnaissance as a war weapon.

Concerning the use of jet aircraft, it is stated that the limiting factor so far has been the range which, although adequate for tactical work, has proved insufficient for long sorties such as were undertaken during the war by Mosquitoes and Spitfires. Present difficulties, however, will be overcome.

In this connection it is of some inter-



RELATIVITY AT RADLETT: So compact is the design of the Handley Page Hastings that its size is not truly appreciated without some means of comparison, provided here by Airborne Troops. The span is 113 feet.

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est to note that the short-span Mark IV Meteor has a range, with full internal tanks, of 560 miles. The use of a ventral drop tank steps this up to 920 miles, and there seems little doubt that the Meteor is capable of being adapted for much greater fuel loads.

Anson for Rhodesian P.M.

AN Avro Anson, March XII, fitted to V.I.P. standards, has been offered by the Air Council to the Prime Minister of Southern Rhodesia, Sir Godfrey Huggins, in appreciation of the assistance given by the Southern Rhodesian Government in the training of R.A.F. aircrews during and since the war. The offer has been accepted and Sir Godfrey has assured the Air Council that the Government and people of Southern Rhodesia will do everything they can to make the present Air Training Scheme a great success. He added that one of the uses to which he will put the Anson will be to visit the training stations from time to time so that he may keep personally in touch with the work carried on there.

Under the wartime scheme, 8,500 British aircrew were trained in Southern Rhodesia. The post-war agreement for the training of pilots and navigators came into force on January 1st last.

Formerly the personal aircraft of A.V-M. C. W. Meredith, who was in charge of the Rhodesian training scheme during the war, the Anson has been taken out of stock and overhauled at Kumalo, near Bulawayo, the headquarters of the Air Training Wing. It will be handed over by A. Cdre. G. G. Banting.

Transport Support Training

DAKOTA squadrons of Transport Command are due, during the spring and summer, to undergo concentrated transport support training in co-operation with glider units and Army paratroopers. The first Dakotas will go to a special practice camp next month.

This training in one of Transport Command's principal rôles has been held up because several squadrons have been used to maintain services to the Continent. It is hoped that the training will culminate in a Parachute Brigade Group exercise in the autumn. Thereafter the squadrons will be fully operational in the transport support rôle and will undergo regular exercises.

Reunions

EX-OFFICERS and aircrew of No. 47 Squadron are holding a reunion dinner at the Connaught Rooms on April 19th at 6 p.m. Those wishing to attend should notify R. Davis, 55, Alington Crescent, Mallard Way, Kingsbury, N.W.9.

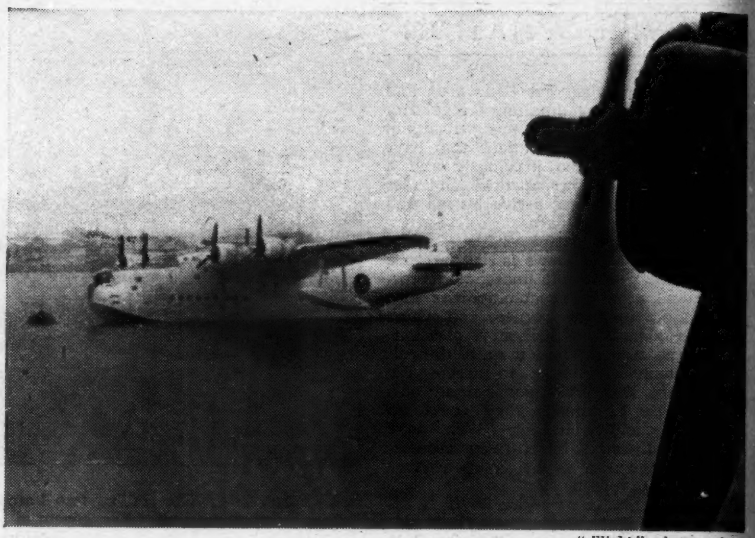
* * *

A reunion dinner for officers who served on the staff of the Central Flying School, R.A.F., will be held at R.A.F. Station, Little Rissington, on May 23rd. Dinner will be 12s 6d and not more than 140 covers can be provided. Limited accommodation can be arranged for the night. Correspondence may be addressed to the Secretary, C.F.S. Reunion, R.A.F., Little Rissington, Glos.

As previous records of the reunion cannot be traced, all past members of C.F.S. are asked to communicate with the secretary, whether they can attend the dinner or not.

* * *

No. 601 (County of London) Squadron, Auxiliary Air Force, is holding a reunion on May 10th at 6.30 p.m. All auxiliaries and regulars who have been with the squadron should communicate with F/L. R. J. S. Spooner, 601 Squadron, A.A.F., The Hyde, Hendon.



"Flight" photograph.

ANGLO-AMERICAN IRISH: A Pratt and Whitney-powered Short Sunderland V from the Short and Harland works awaits collection from Belfast Lough. The Sunderland V differs from the Mk. III in power plant and armament.

Permanent Commissions

THE following Officers have been selected for permanent commissions in the R.A.F.:—

GENERAL DUTIES BRANCH

G/C.—W. H. M. Walker.

W/C.—G. G. N. Barratt, A.F.C.; R. L. C. Branson, O.B.E.; R. J. Harden; J. R. H. Lewis, D.F.C.; A. S. Mann, D.F.C.; N. A. Sellars.

S/L.—O. H. Archer; L. V. Bachellier, A.F.C.; J. F. Brookes, D.F.C., A.F.C.; H. F. Bucknell, A.F.C.; R. I. Crump, A.F.C.; R. A. R. Falconer, D.F.M.; T. W. G. Godfrey, D.F.C.; E. Goldsmith, A.F.C.; D. G. T. Hayes, D.F.C.; F. W. Higginson, D.F.C., D.F.M.; J. L. Kerr; F. W. J. Paddon, A.F.C.; A. G. J. Pearson, A.F.C.; R. A. Pegler, A.F.C.; M. K. Sewell, D.F.C., A.F.C.; S. C. Sutton, O.B.E.; A. G. Swann, M.B.E.; J. Wright, D.F.C., A.F.C.

F/L.—K. Barnes; P. D. Bird; R. Bradwell, D.F.C.; M. M. Davison, D.F.C.; A. MacD. Dow; E. L. D. Drake, D.F.C.; W. F. Jowsey, D.F.C.; B. G. Lock; L. S. Lumsdaine, D.F.C.; D. G. McCall; K. A. Major, D.F.C.; S. J. Perkins; E. S. Smith; G. H. S. Smith; L. H. Tester, D.F.M.; E. B. Trumshaw; R. J. G. Tumilty; G. J. Wishart, D.F.C.; P. D. J. Wood, D.F.C.

F/O.—C. C. Allen.

TECHNICAL BRANCH

W/C.—R. L. Bloodworth; N. A. Smith, M.B.E.

S/L.—G. E. Burtenshaw; P. C. Cleaver, O.B.E.; W. R. Cumbers; F. H. Dimmer; F. E. Dudley; J. E. Mason; E. Mortimer; L. C. N. Penney; B. T. T. Pook; H. Tilzey, M.B.E.; W. F. Wallington, D.F.C.

F/L.—H. F. Bishop; W. C. T. Brown; J. D. Crawford; J. C. Dixon; M. G. Fountain; P. C. Santhony; L. Greenhalgh; E. J. Groombridge; T. H. Hignett, M.B.E.; F. A. H. Jenkins; T. J. V. McCroddan; W. J. H. Miller; R. H. Phillips, B.E.M.; G. L. Quirk; L. G. Raspison; T. G. B. Sayers; I. Scott, B.E.M.; R. S. Shepherd; F. A. Short; E. W. Stanley; R. H. Vernon; S. G. R. White; L. T. Wright.

F/O.—C. W. Chesney, M.B.E.; J. Hartley.

P/O.—M. B. C. Preston.

SECRETARIAL BRANCH

W/C.—C. E. Brown; J. M. Wells, M.B.E.

S/L.—L. Barron; P. M. K. Bird; A. Price, D.F.C.; R. S. F. Williams, O.B.E.

F/L.—H. E. Davis, A.F.C.; A. A. Goddard; W. H. Hulin.

EQUIPMENT BRANCH

W/C.—G. Steele, M.B.E.

S/L.—F. A. Buckingham; R. S. Coleman; J. P. Eskdale; G. E. Firkin; J. H. Lucie-Smith; A. Mills; O. F. Owens; J. B. Quarrington.

F/L.—G. H. Jarrett.

MEDICAL BRANCH

S/L.—J. A. MacCarthy, G.M., M.B., B.Ch.

DENTAL BRANCH

F/L.—P. A. Askew, L.D.S.; W. A. T. Parsons, L.D.S., R.C.S.; C. E. Ockleford, L.D.S.

R.A.F. REGIMENT

S/L.—F. A. Price.

F/L.—A. J. Orbell.

F/O.—S. Arnold.

CATERING BRANCH

S/L.—P. Caddy; W. H. Canniford; J. C. Thurston.

F/L.—F. T. Brain; R. C. Chamberlain; F. Evans; J. D. Twidale.